Heating · Piping and Air Conditioning

with which is merged the "Aerologist"

Design, Installation
Operation, Maintenance
in Industry and Large Buildings

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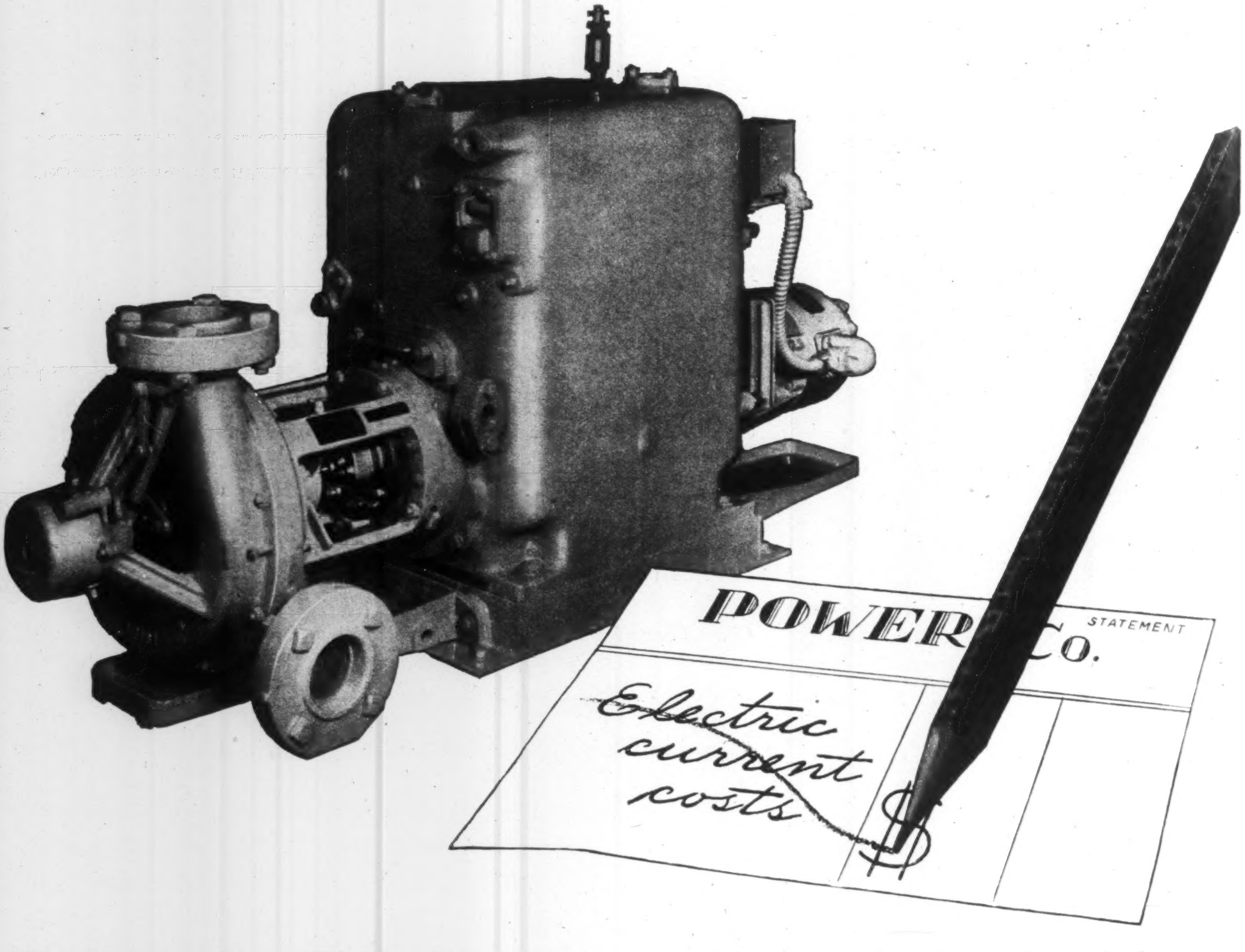
A NASH VAPOR TURBINE HEATING PUMP WILL ELIMINATE THIS EXPENSE ITEM.



The Jennings Vapor Turbine Return Line Vacuum Heating Pump requires no electric current, eliminating the one biggest expense item in the operation of an ordinary return line pump. This is because the motive power is a special turbine operating on steam direct from the heating system. Steam used to drive the turbine is returned to the system for heating, with little heat loss.

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THE NASH ENGINEERING COMPANY
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Heating·Piping
and Air Conditioning
Vol. 10, *No.* 12 ● *December*, 1938

Zone Control Cuts Fuel Needed to Heat Huge Merchandise Mart

By W. A. Stahl*

The Mart is a building of 58,000,000 cu ft

In the fall of 1937 the Merchandise Mart, Chicago, installed a system of zone control for all the direct radiation in the building, as well as a complete system of combustion control for the stoker fired boiler plant, steam flow meters, and other instruments. The direct radiation in the Mart cares for the wall heat losses and comprises about 45 per cent of the heating load of the building, the balance of the load being for heating the ventilation air.

This equipment, its operation, and the basis on which it was purchased were described in detail just a year ago,[1] but at that time it had not been in use long enough to report the results obtained. Now, after a full year's operation, it is possible to measure the results against the expected savings.

There are seven natural divisions of the building created by the fire walls, and each of these sections is served by a single riser, with a separate riser for the tower section. An outside thermostat control is installed for each of these sections, each connected to high pressure two position valves on the 19th floor and to a control panel in the boiler room. Each zone control valve may be controlled by manually operated switches from the panel in the boiler room. A three position switch at the control panel allows each zone valve to be closed, opened, or put under automatic control of its outside thermostat. In addition to the manual switches, there are also switches on the control panel for placing the system in a night shutdown position or in position for normal day operation. A mechanism is provided so that all the zone valves will not operate simultaneously, thus calling for an excessive amount of steam, but will follow in sequence so that even boiler pressure can be maintained.

This control arrangement has operated very successfully in maintaining comfortable temperatures in the Mart throughout the range of outside temperature which has been encountered. It is, of course, difficult to set a temperature that is 100 per cent satisfactory in a building with the many types of occupancy as are present in the Mart. The size of the tenant spaces ranges from 90,000 sq ft occupied by Montgomery Ward & Co. to small offices of 400 sq ft. Some of the apparel manufacturers include in their spaces salesrooms, warehouse and factory. The furniture and house furnishings lines present such problems as that of the 12th floor, where lamps are exhibited and where the lamp load averages in excess of 5 watts per sq ft.

We have, however, found a temperature of 73 F satisfactory to most tenants. A certain variation is possible to satisfy individual requirements by regulation of the incoming air furnished from the various fan rooms, as ventilation is supplied to all floors of the building. The operation of the cycling feature—which controls the valve action for the various sections to maintain even boiler loads and frequent, short periods of steam supply—has been most satisfactory. In addition, water hammer has been eliminated in sections of the building far removed from the boilers. The type of zone valve used allows for a leakage of about 2 per cent, and this slight steam flow serves to keep pipe lines warm and so tends to prevent the water hammer which might result with a tight valve.

---

*Operating Engineer, Real Estate Div., Marshall Field & Co.

[1] "World's Biggest Building Installs New Heating and Combustion Control," by W. A. Stahl, Heating, Piping and Air Conditioning, December, 1937, pp. 721-724.

Comparison of Operating Results

A comparison of the operating results for a 13 month period for the years 1933-1936 (average for one season) before the new control system was installed, and the 1937-1938 season after the controls were put into service, is given in the tabulation here.

Before Control

Month	Degree Days	Tons of Coal Used	Lb of Coal per Degree Day
Oct.	345	948	5495
Nov.	741	1616	4389
Dec.	1112	2527	4545
Jan.	1134	2741	4929
Feb.	1174	2814	4794
Mar.	811	2010	4961
Apr.	579	1340	4628
May	214	602	5672
June	62	59	1900
Sept.	72	171	4750
Oct.	345	948	5495

Average lb per degree day per year, 4687. Occupancy factor 1.00.

After Control

Month	Degree Days	Tons of Coal Used	Lb of Coal per Degree Day
Oct.	443	997.5	4526
Nov.	825	1610.5	3904
Dec.	1188	2374	3997
Jan.	1230	2445	3976
Feb.	853	1626	3812
Mar.	623	1318	4231
Apr.	456	945	4145
May	248	504	4065
June	25	23.5	1880
Sept.	89	139.5	3135
Oct.	235	549.5	4680

Average lb per degree day per year, 3841. Occupancy factor, 1.09.

(Note—The average fuel figure would be somewhat lower if a 12 month instead of a 13 month period were used in the above).

Based on this tabulation, and correcting for occupancy, the fuel saving based on the previous consumption is about 20%. If there had been a normal number of degree days during 1937-38, the saving would have been somewhat higher. In surveying these results, it should be mentioned that 28 fan rooms with 33 fan units have been added since the tons of coal consumption per degree day were specified in the control contract. The indirect radiation in these fan rooms totals 22,650 sq ft (actual). In addition, tenant occupancy has increased from fifteen thousand to twenty-five thousand; thus the fuel consumption for the process load, which was set at 250 tons per month, has increased considerably.

The largest dollar savings have naturally been made during the colder months. A copy of the January chart is reproduced here which indicates the daily saving. On this chart, the *total length* of each daily column shows the fuel consumption as would obtain on the 1933-1936 basis. The upper portion of each daily column (except January 25) indicates the savings over 1933-1936 figures, the cross-hatched portion indicating actual coal consumption for 1937-1938.

The savings for Sundays are exceptionally large for two reasons:—All fans are shut down and, in addition, risers are shut off manually. In effect, shutting down on Sundays tends to show a larger saving in that day, the monthly total not being greatly affected. The Monday saving is definitely decreased because a larger load must be picked up.

The variation in saving on days of approximately equal degree days can be accounted for only by the fact that degree days do not take into effect sun and wind conditions which can vary the load at a given temperature as much as 30 per cent. For instance, on January 6 and 13, the degree days were equal and there was a great variation in saving. On January 6, the average wind velocity was 13.6 miles; prevailing direction, northwest; maximum velocity for 5 minutes, 21 mph; momentary 30 mph velocity; no sunshine. On January 13 the average wind velocity was 9.8 mph; prevailing direction, south; maximum velocity for 5 minutes, 16 mph; momentary 25 mph velocity; 5 hr sunshine. It is interesting to note that even though the average air change in the Mart is in excess of four per hour, there is a lag of three days upon an abrupt change in weather.

In the fall of 1937, the 58,000,000 cu ft Merchandise Mart was equipped with zone control governed by outside thermostats, combustion control, and instruments. After a full year's operation, the fuel savings have been determined to be 20 per cent, as reported here by the engineer

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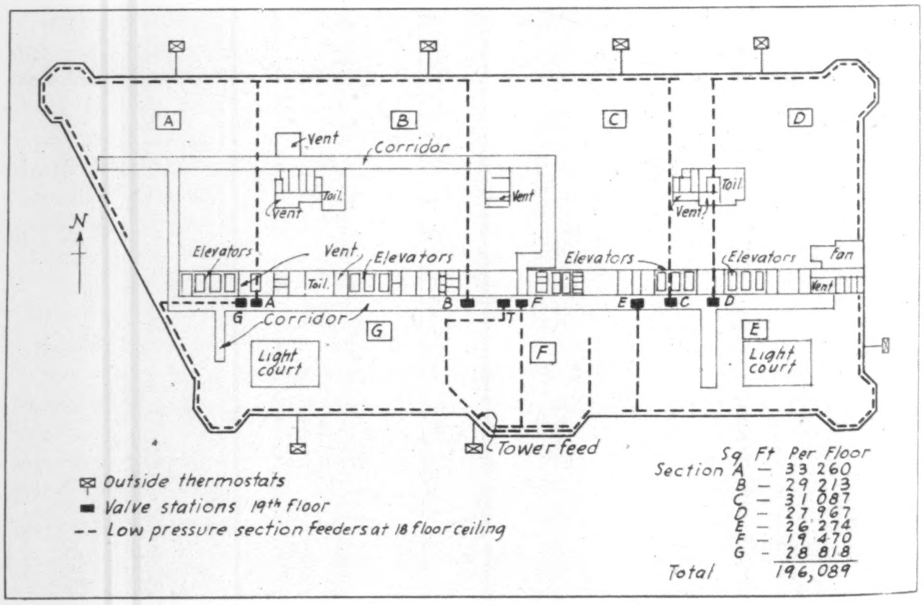
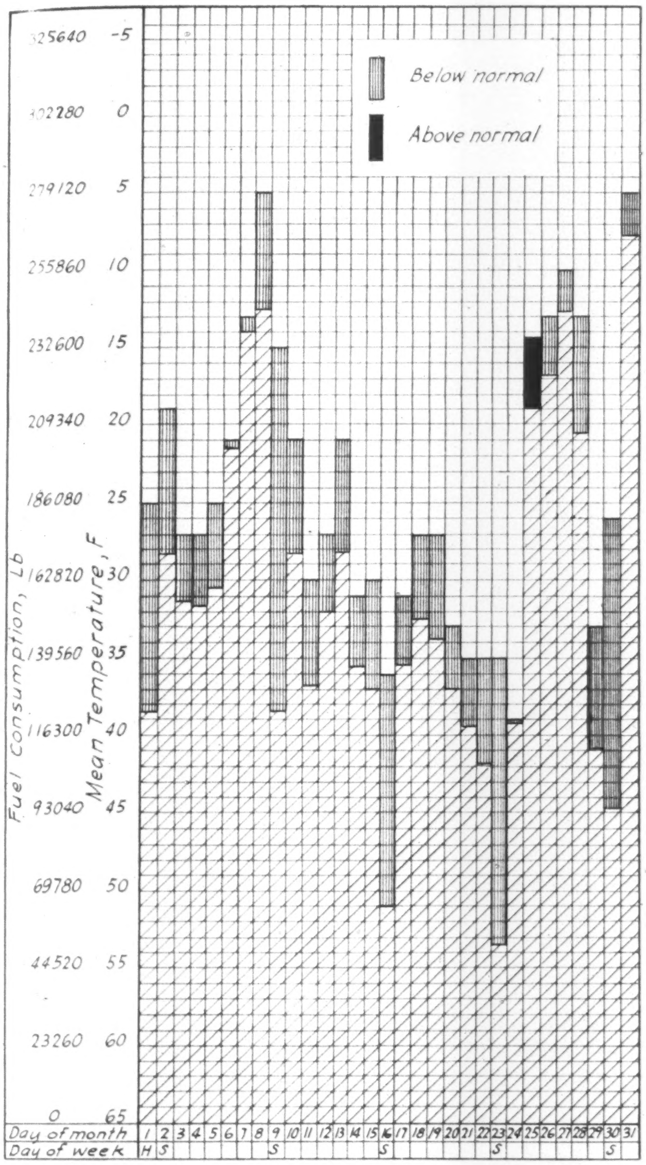
Floor plan of the Merchandise Mart showing the location of the outside thermostats, zone valves, and main steam distribution





Fuel consumption chart for January, 1938

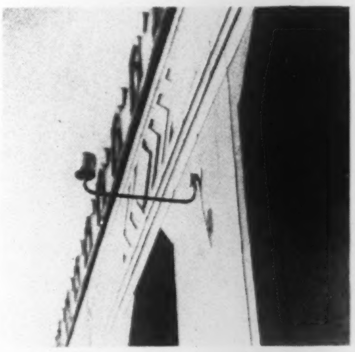
Contents of building, 58,000,000 cu ft; total direct radiation, 218,271 sq ft; total indirect radiation, 113,426 sq ft; total number of heating hours—indirect, 224.5, direct, 455.0; total degree days, 1230; total normal degree days, 1256; departure from normal degree days, 26; total lb fuel consumed, 4,890,000; daily average fuel consumed, 157,741 lb plus; lb fuel per degree day including Sundays and holidays, 3975.6; lb fuel per degree day per 1000 cu ft building volume including Sundays and holidays, 0.06853. The fans at the Mart handle about 4,000,000 cfm of air.

The Boiler Room Equipment

It has not been possible to determine what portions of the savings are due to the zone control system and what portion is due to the boiler room equipment installed at the same time. This boiler room equipment consists of seven steam flow meters, seven four point draft gages, seven CO_2 and stack temperature recorders, undergrate dampers on seven boilers, seven boiler horsepower indicators, and variable transmission drives for the operation of chain grates. Recording and indicating instruments are all mounted on a panel approximately 10 ft by 20 ft in the boiler room.

Some difficulty was experienced in synchronizing the operation of the draft control and coal feed. The original installation provided for balanced draft on each boiler, variable speed coal feed control and a main stack damper control. These are now being changed to motorized dampers operating from a master steam pressure controller. The pressure controller formerly was connected to the main steam header and was sluggish. The new pressure controller is connected to the bottom of the two main steam risers.

The operation is now very satisfactory because the slightest demand for steam is instantly transmitted to the master controller, which in turn opens the individual boiler damper, transmitting the demand for more fuel to the variable speed feed controller through a static pressure regulator, which is installed on each boiler.



One of the outside thermostats

Performance of the indicating equipment has not been entirely accurate because of the large amount of water carried up with steam. There are no dry pipes or baffles in the boilers. It is intended to install some type of equipment to eliminate the water from the steam.

The CO_2 indicators, together with other instruments, provide a ready check on combustion efficiency. The Mart has partially financed a combustion course for all of its operating engineers in order that the equipment will be understood and used at maximum efficiency. They have shown the utmost cooperation in operation of the equipment.

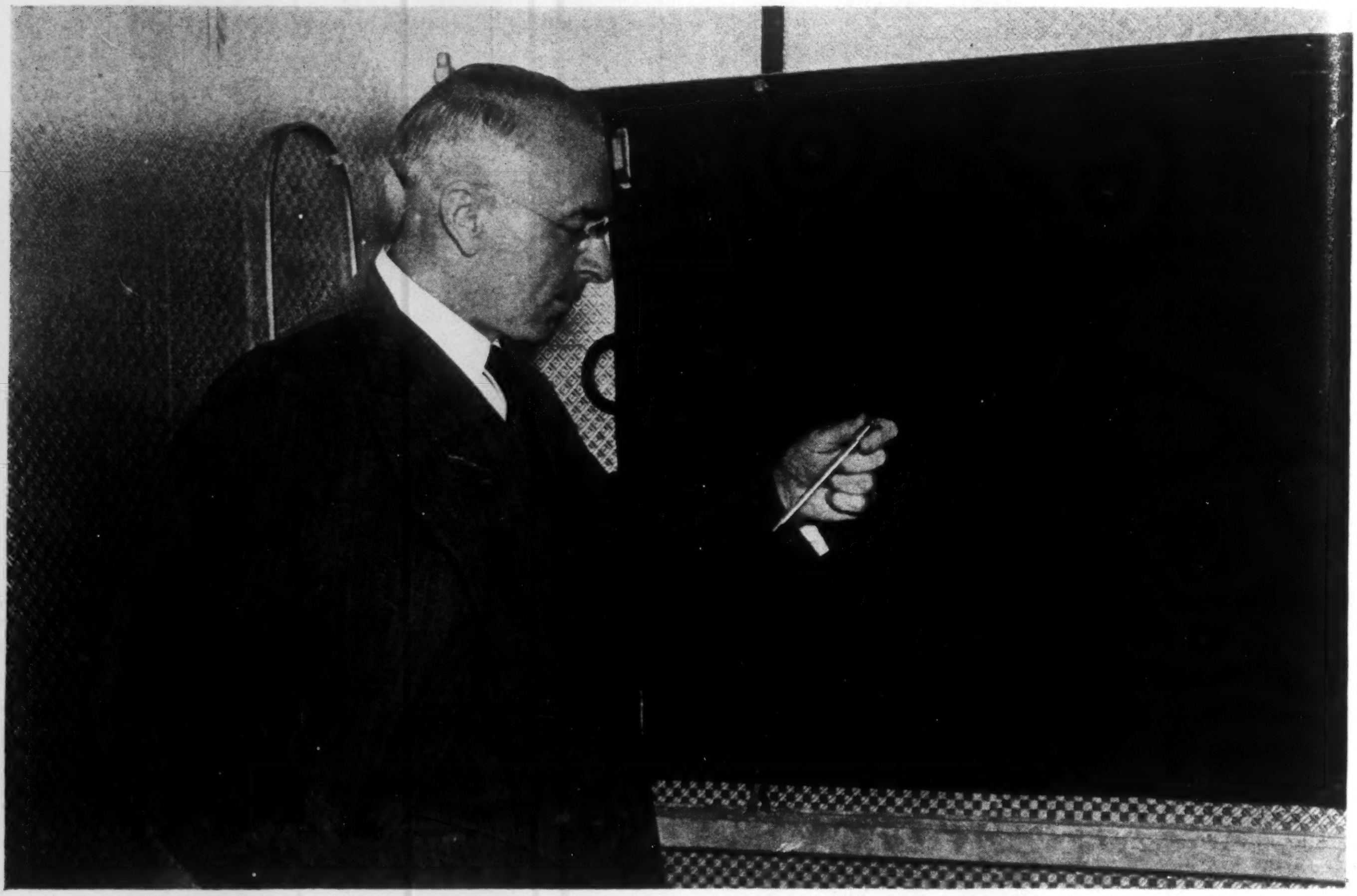
In view of the fact that considerable additional load has been added during the year, such as fan room heating coils, process steam and humidifying equipment, the saving has been very satisfactory.

Speaks on School Buildings

The heating and ventilating of modern school buildings has progressed even more rapidly than the structural side, according to Alfred C. Lamb, superintendent of buildings and grounds, Wayne University, speaking before the National Association of Public School Business Officials recently. Automatic control of dampers and radiators, as well as of the heating plant, has developed rapidly in recent years. We now have automatic electrical regulation that will maintain building temperatures within 2 deg and make a record of the temperature of each room at 3 min intervals.

Heating is being done by hot water circulated continually by pumps through the radiators with controls to shut off and bypass any radiator when the room is at the proper temperature. Heating systems using hot water in the radiators and air for ventilation heated by the same water are working satisfactorily and economically.

Air filters have been improved rapidly. They are efficient and easily cleaned, although most of the air for ventilating is still washed by water.



Dr. Mills inspects one of the cold plates

Hospital Installs Radiant Conditioning System

By C. A. Mills, M.D.,* and John Gorrell, M.D.**

LAST year considerable interest was aroused among air conditioning engineers over the studies being made on reflective radiant conditioning at Cincinnati.[1] It was shown that body comfort and rate of body heat loss could be satisfactorily controlled through radiant channels, without regard to air temperature or humidity levels. The tests, however, were carried out in relatively small chambers under artificially controlled conditions.

The idea has now been given a successful field test in a regular hospital operating room at the Blodgett Memorial Hospital, Grand Rapids, Mich., and it is in response to the interest generated by this installation that the present brief report is published. Satisfactory operating conditions were maintained in the room during August, with comfort for surgical and nursing staff regardless of prevailing air temperatures. It is true that no severe heat waves occurred at Grand Rapids after the room was put into operation, but experience with its operation so far gives good grounds for the belief that it will be equally successful in severe summer heat.

Detailed description of the room and equipment is unwarranted at this time. Is is somewhat crude, but none the less effective. The room as completed is roughly 12 by 17 by 10 ft, with two cold plates on opposite walls and the entire wall and ceiling surface faced by aluminum foil wall covering.

With normal operating room occupancy, summer comfort was provided by radiant heat absorption onto the two plates, even though their surface temperature did not go below 50 F. Effective radiant cooling could be demonstrated at any time by turning on the steam heat in this and the adjoining operating room, bringing them both up to 92 F air temperature and 50 to 60 per cent relative humidity. At such time, the untreated room was uncomfortably warm (when so tested in September) while the one fitted for radiant heat removal was not at all disagreeable.

Arrangements are now being made for reversing the process, so as to provide winter comfort in the room by radiant heat input under proper automatic control. A more detailed report of the whole installation will be made later, when definite statistics regarding its operation have been assembled.

---

*Professor of Experimental Medicine, University of Cincinnati.

**Blodgett Memorial Hospital.

[1] "Control of Body Heat Loss Through Radiant Means," by C. A. Mills and Cordelia Ogle, A.S.H.V.E. *Journal Section*, HEATING, PIPING AND AIR CONDITIONING, November, 1937, pp. 697-699.

Air Conditioning for Human Comfort Discussed by Leading Authorities

[Report of Air Conditioning Symposium held November 22]

SOME 900 architects, engineers, contractors and others jammed the auditorium of the Engineering Building, Chicago, the evening of November 22 to hear seven authorities discuss air conditioning for human occupancy. Many were turned away at the doors, for the subject of the symposium and the impressive list of speakers attracted not only those in the Chicago area but numerous out-of-town visitors as well.

The meeting was jointly sponsored by the Chicago chapter of the American Institute of Architects, the Illinois Society of Architects, the Illinois chapter of the American Society of Heating and Ventilating Engineers, the Chicago Association of Consulting Engineers, the Air Conditioning Manufacturers' Association, and the consulting engineers' division of the Western Society of Engineers. The speakers were Dr. Irving S. Cutter, dean of the Northwestern University medical school; Charles S. Leopold, consulting engineer; John R. Hertzler, York Ice Machinery Corp.; Albert Buenger, Delco-Frigidaire Conditioning Div., General Motors Corp.; Elliott Harrington, General Electric Co.; William B. Henderson, Air Conditioning Manufacturers Association; and Willis H. Carrier, Carrier Corp. Members of the committee that arranged the affair were William Jones Smith, Chicago chapter of the A. I. A.; Leo J. Weissenborn, Illinois Society of Architects; Leigh S. Keith and Robert E. Hattis, Western Society of Engineers; E. T. Murphy and R. L. Jones, Air Conditioning Manufacturers' Association; Samuel R. Lewis, Chicago Association of Consulting Engineers; John Aeberly, Chicago board of health; and J. R. Vernon and Tom Brown, Illinois chapter of the American Society of Heating and Ventilating Engineers.

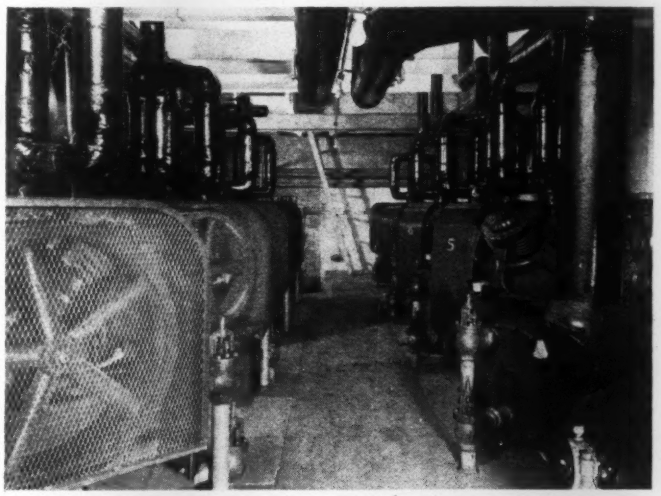
John Howatt, past president of the A.S.H.V.E. and chairman of the Chicago committee on air conditioning, was the presiding officer. He opened the session promptly at 7:30 p. m.—as advertised—with a brief introduction; to him should go credit for keeping the full evening's program on schedule so that the final speaker concluded his remarks a minute or two before 11 o'clock.

Dr. Cutter First Speaker

Dr. Cutter, the first speaker, discussed the importance of correct air conditioning and some dangers to avoid. He said that excessive heat is a great disturber of the nervous system, and hence of sleep, and that high humidities prevent what is known as "invisible perspiration." He said summer air conditioning for comfort achieves two important objects, the extracting of bacteria from the air and allowing evaporation from the surface of the body. Dr. Cutter warned against too great a difference in temperature between outside and inside, and felt that 15 deg was the maximum. He said that we all want comfort, and that the measure of a summer conditioning system as far as the occupant is concerned is "no sense of chilling and air that is nice to breathe." The speaker stated that when one is chilled the blood goes to the visceral organs due to contraction of the capillary vessels in the skin, and causes congestion. (A later speaker, in referring to Dr. Cutter's remarks, referred to some tests just published in the medical press that showed a 30 per cent change in blood volume after 15 days exposure of the subjects to high temperatures.)

Engineering Aspects

Charles S. Leopold was the second speaker, and introduced his discussion of the engineering aspects of air conditioning with brief definitions of the terms used, such as dry bulb, wet bulb etc. He then discussed effective temperatures, and showed curves of winter and summer "discomfort lines," which indicated that the commonly used design standard of 80 F dry bulb and 50 per cent relative humidity is a high limit. It is Mr. Leopold's belief that when an air conditioning installation is successful "the occupant is oblivious to his atmospheric environment." In other words, the occupant should not be conscious of his being in an air conditioned atmosphere, but rather should be relieved of any discomfort by means of air conditioning. Mr. Leopold did not feel that too much importance should be attached to so-called "entrance shock."


Eight 50 hp condensing units supplying about 400 tons cooling effect to a total of 17 conditioners for 17 zones in a store, each of which is under individual control

He referred to the Metropolitan Life studies—which failed to indicate any positive benefit in health of occupants due to air conditioned offices—and said these results were not surprising, but were gratifying, as they indicated we can produce summer comfort without harm to the health of individuals. He mentioned that various school ventilation studies on natural and mechanical ventilation have yielded negligible results, and said that when analyzed about all they have proved is "that respiratory illnesses follow wet weather and are proportional to the distance between the school and the pupil's home." He summed up his views on air conditioning and health by saying that the removal of discomfort by air conditioning so long as it doesn't harm health is the important end in itself.

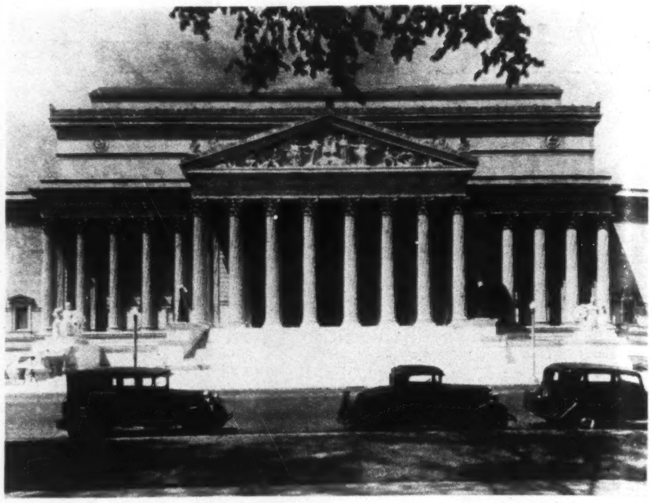
The speaker then showed diagrams of and discussed various types of air conditioning layouts, with particular attention to systems using silica gel and lithium chloride for dehumidification. He described use of water from wells for precooling and cooling the air to save refrigeration cost, which water is later sprayed on the roof of the air conditioned building. Among the plants diagrammed was that for the U. S. Capitol, supplied with chilled water from a central 4800 ton refrigeration plant. In one of the government buildings supplied from this plant, central type systems are provided for each of the four exposures, a "run-around" water cycle being used with the plant for the north exposure to improve control of the air conditions.

Mr. Leopold's address indicated very definitely that air conditioning is a real engineering problem and that there are many factors to consider. There is no one type of system which is universally the best, the choice depending upon the situation and factors involved in each specific case.

Health Standards

Mr. Hattis then read a letter from Prof. Philip Drinker of the Harvard school of public health, who had been invited to speak on health standards in air conditioning from the viewpoint of the public health man but who could not come to Chicago for the meeting. Prof. Drinker stated that in the field of industrial hygiene there are standards for gases like carbon monoxide and dusts like lead, but that the air conditioning engineer (as contrasted with the ventilation engineer) is not interested in such toxic limits, as he deals mostly with air free from poisonous or odorous substances. He did not feel that we had as yet reached the point where well defined standards or narrow zones for air conditioning as applied to buildings are admissible. For instance, granting that we can now have bacteria free air, Prof. Drinker felt that as yet there is no proof that our general health is thereby benefited (save that sufferers from hay fever and asthma are benefited by special pollen free air conditioned rooms). He felt that experiments along these lines should be encouraged, but that results so far do not permit us to include bacteria free air, for instance, as generally desirable. In the face of "such cantankerous and unpredictable" outdoor weather as New England has experienced in recent months, Prof. Drinker expressed the belief that it "seems rash to attempt too much uniformity or standardization indoors."

Mr. Hattis agreed that it is difficult to define specific standards and that such standards would be changed in the light of new research. He mentioned some of the factors involved, and hoped for the reports of more studies on factors affecting comfort, shock on entering and leaving a cooled space, and the so-called vitalizing properties of outdoor air.



The impressive Archives Building of the United States in Washington, D. C., which is air conditioned primarily for the protection of valuable documents. Sulphur dioxide content of the air is maintained at a definite minimum

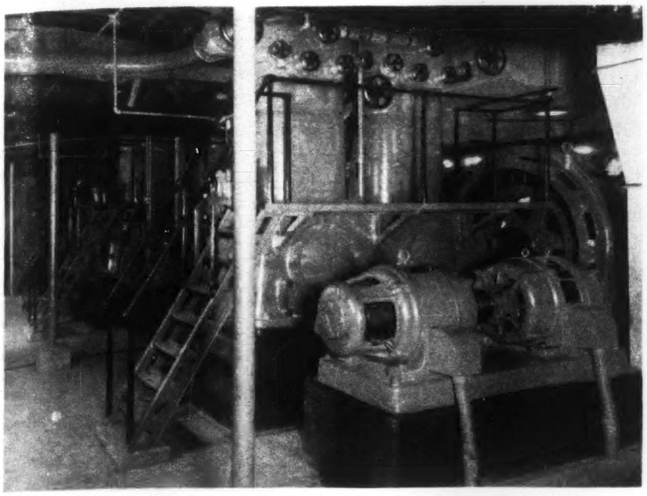
Refrigeration for Air Conditioning

Mr. Hertzler, the next speaker, discussed refrigeration as applied to air conditioning. He stated that (1) the operation of an air conditioning system will require the consumption of some form of available energy, and that the types of energy which have been successfully utilized are electricity, coal, gas, and oil; and (2) since heat as a form of energy cannot be destroyed, it must be dissipated from the summer air conditioning system by one of several available means, which include use of well water, river water, city water, air, spray ponds, cooling towers, or evaporative condensers. He then discussed the various types of available equipment, and some of the factors involved in choosing which one shall be used.

He showed an outline of the forms of energy used to operate air conditioning refrigeration systems and the types of systems using each. Electricity is used for motor driven compression refrigeration and adsorption systems (for regenerating the adsorbent). Gas is used for absorption refrigeration, adsorption, and for gas engine driven compression refrigeration. Oil is used for oil engine driven compression refrigeration systems. Coal, oil, gas or electricity may generate steam which may be used in absorption refrigeration, adsorption, absorption, steam ejector refrigeration, or steam engine or steam turbine driven compression refrigeration.

The Architect's Problem

Mr. Buenger then spoke on the structural items in the architectural design of buildings to be considered in connection with air conditioning, confining himself to the cooling phase of the subject. He said that the problems of air conditioning are not all entirely new to the architect, for he has been confronted with some of them many times before in his heating and ventilating work. They may be classified as coming under three general headings: the design of the system within the condi-



Vertical reciprocating compressors for air conditioning the Archives Building, each of which is driven by a 300 hp synchronous motor. Chilled water is supplied to the eight dehumidifiers in eight separate zones of the building

tioned space, the selection and location of equipment for the system, and finally the service requirements.

The handling and distribution of air within the conditioned space is probably the least understood phase of air conditioning. Cold air, as a rule, cannot be satisfactorily introduced laterally into an occupied space below the tops of the occupants' heads without producing drafts. This is the reason for high register locations in air conditioned rooms. The location of air inlets and outlets is consequently of prime importance. A compromise between the aesthetic and engineering requirements must frequently be made. The heavily ornamented cast metal or plaster grille is frequently not suitable for proper cold air diffusion.

There are no fixed rules to be followed for the transmission of the conditioned air to the space to be conditioned. The one thing to be remembered is that space must be provided for supply and return air ducts and flues from the equipment room to the space to be conditioned. The ducts may be exposed or concealed as the building requirements demand.

Cold air ducts, however, frequently must be insulated to prevent heat gain, to prevent condensation on the outside of the ducts where the conditioned air temperature is below the dew point of the surrounding atmosphere, and in some cases to eliminate noise transmission from the equipment room to the conditioned area.

It is highly important that the architect be fully informed on air conditioning costs. There is no short cut, no royal road, to estimating of air conditioning costs. Accurate estimates can only be arrived at by a careful assembly of labor and material costs. However, experience has given us some "yardsticks" of measurement based on the ton of refrigeration. These costs are variable according to the size of the job as follows: 1 ton, $500; 2 to 3 tons, $400 per ton; 3 to 9 tons, $325 to $375 per ton; 10 tons and above, $225 to $350 per ton. This is equivalent to $1.00 to $1.50 per sq ft of conditioned space, he said.

In order to reduce costs, we must look for ways and means of reducing the load. Suppose we assign a dollar value to the load by assuming that each ton costs $300. We can then discuss load in terms of dollars in place of tons. For example, insulation equivalent to 4 in. of rock wool will reduce the load $75 per 1000 sq ft of wall. The installation of awnings will reduce the cost as much as $4 per sq ft of window exposed to the sun. Many buildings with flat roofs offer the possibility of evaporative cooling. The use of water sprays or a sheet of water has the effect of practically eliminating 100 per cent of the sun exposure. The cost reduction may be as much as $200 to $300 per 1000 sq ft of roof. (Here, problems are encountered in roof construction, as not all roof construction is suitable for roof sprays. For example, tar or pitch is preferable to asphalt, as the latter tends to rot when submerged constantly).

It is further of importance that an accurate count or estimate be made of the occupants of the space to be conditioned. True, the architect has no control over the people who will occupy his building, but he should make every effort to determine the number of occupants, as a saving of $10 to $12 per person can be effected if "more persons stay out of the building."

The reduction of the lighting and electrical appliance load will reduce the air conditioning costs to the extent of $9 for each 100 watts. (To introduce a word of caution here, frequently installations of air conditioning in existing buildings will influence the owner to make improvements in lighting systems, which will of course have its effect on the air conditioning load.)

Finally, the load may be reduced by removing some of the internal heat by proper ventilation. Here again a word of caution is in order as each 100 cfm exhausted must be replaced by a like amount of outside air, and that means $85 for each 100 cfm of air introduced.

Reduction of costs by reducing the load, as outlined, does not necessarily mean that any one trifling reduction of the load will reduce the cost of the contract a corresponding amount, Mr. Buenger stressed. The careful attention to all of these details may produce a cumulative reduction in the estimate which will frequently permit the selection of smaller equipment with consequent reduction in costs. In other words, air conditioning equipment comes more or less in standard sizes.

Installations Illustrated

Mr. Harrington then showed numerous slides of air conditioned buildings in his discussion of practical applications of air conditioning; he divided his paper into three important building groups, residences, commercial buildings (such as stores), and public assembly rooms (such as theaters). The illustrations reproduced with this report have been taken from the group Mr. Harrington threw on the screen at the meeting.

Products Available

The next speaker was Mr. Henderson, who gave a broad view of manufactured products available to the air conditioning industry. In his introductory remarks, he said that air conditioning's first popular appeal for comfort was its cooling and dehumidification aspects, but felt that this has been a mixed blessing. While it has probably been the greatest single factor in the tremendous public acceptance of air conditioning, air conditioning should be thought of as a year 'round necessity, and the industry feels it to be an unfortunate situation for cooling to occupy such an inordinately prominent place in the public mind.

The speaker mentioned the improvements which have been and are still taking place in air conditioning equipment. He suggested to architects that the solution to their air conditioning problem is to work with an experienced and competent air conditioning engineer. He said that the architect should take the time and trouble to familiarize himself with air conditioning, for it is here to stay and an integral part of the American way of living.

Development of Air Conditioning

The final speaker was Mr. Carrier, who had been invited to talk on the development of air conditioning, a subject he has been working on since 1902 when it was desired to control the relative humidity in a lithographing plant. Moisture was removed by condensation on pipe coils through which cold water was circulated. The experimental work, and other research, lead to development of the spray process, and to the two papers—classic in the air conditioning field—presented before the A.S.M.E. in 1911. The term "air conditioning" was first coined in 1907, by Cramer.

Mr. Carrier discussed many of the developments in air conditioning since his early work on the subject, including the spray type system or dewpoint control, the downward pan outlet system of air distribution, bypassing, the centrifugal compressor, non-ferrous surfaces, and "Freon."

We need a better understanding and perhaps rules enforced by state regulations regarding the minimum conditions allowable in an air conditioned space, Mr. Carrier said. These requirements should be based on the condition of occupancy as well as the outside temperatures. Places in which people remain a short time should have a higher temperature than those places where they stay a longer time. In the air conditioning for manufactured products, particular attention is always given to the humidity. In air conditioning for human comfort, however, the emphasis has been generally placed on temperature. This is undoubtedly a mistake on the part of the vendor as well as on the part of the user. A reasonably low relative humidity with a higher dry bulb temperature is decidedly preferable to a lower temperature with a high humidity, even though they lie on the same line of effective temperature on the human comfort chart. The so-called "comfort chart" is, in the minds of many, mis-named. What this chart really does is to give the lines of equal temperature sensation, but summer discomfort comes as much from excessive moisture next to the body and in the clothing as it does from a sensation of warmth. High atmospheric humidities may indeed evaporate nearly as much moisture from the body as low humidities at the same room temperature but this alone is not the criterion of comfort. With high humidities the effect is to condense moisture in the clothing. This is especially noticeable where people are coming immediately from out-of-doors and therefore perspiring freely. In such cases the clothing at once becomes highly conductive and a chill is frequently experienced when temperatures are carried too low. This is a very complex subject which only recently is being given the study that its importance deserves.

He predicted that in the future, air conditioning will be generally accepted as heating is at present, on the grounds of increased efficiency, as well as improved health and comfort. There are many problems to be solved before this objective is obtained. First, the fundamental difference between true air conditioning and mere cooling must be understood, not only by the manufacturer but by the purchaser and the public. Air cooling alone is not air conditioning. Second, the cost of owning and operating must be greatly reduced. The biggest element, both in the owning and operating cost is the refrigeration. This must and will be greatly simplified and there will be considerable, although not startling, improvement in power costs.

There have been great improvements in the methods of disposal of condenser heat other than by using city water. Still further improvements can and will be made. In many instances large refrigerating systems may be energized directly from the heating boilers rather than employing outside power, as at present. If the electric distributing lines gradually reach their summer peak load due to the rapid increase of air conditioning, it will become desirable both from the standpoint of the power companies as well as the user, to relieve this peak by making the large plants partially independent at least of outside power suppy, while at the peak load.

The refrigerating machine now accounts for 80 per cent of the total maximum air conditioning power load, yet it accounts for less than one-half of the annual power load for the air conditioning plant. This also may be remedied by storage systems in which the refrigeration can be stored up during periods of light power load. Undoubtedly favorable differentials in power rates would be most potent in bringing this about.

Another field in which air conditioning will be promoted is in a more complete standardization in large systems of air conditioning which will result in low operating cost and much better year around operation. Since heating is a function of air conditioning, the two must inevitably be combined rather than be regarded as distinct features, as at present. This will also result in a lower combined cost. Individual cooling units for different rooms will never be a permanent solution. They are only a stop gap in the general scheme of progress in the art and their future lies largely in individual rather than in group installation.

A practical although a rather revolutionary system must be evolved for complete air conditioning of buildings. The ideal system of the future is one that controls automatically the temperature and humidity in accordance with the individual requirements in all parts of a building. Such a system must function satisfactorily, not only in summer and winter, but also in intermediate seasons where there are frequent abrupt changes during the day from heating to cooling requirements.

Much will be done in the future in the improvement of window construction which will make proper air conditioning possible and practicable. In general, although the principles of air conditioning will remain the same as those recognized more than a quarter of a century ago, the developments in application and improvement have only started. This improvement, however, as has been the case in other fields, will probably be marked by no single revolutionary change.

By R. W. Clark*

This paper—which was presented at the annual meeting of the American Welding Society recently—reports the results of two series of tests on arc welded joints in carbon-molybdenum piping. The first series was made to determine the effect of groove design, whether or not general chipping of each bead is necessary, and the value of a recording voltmeter as a means of checking soundness of welded joints. . . . The second series of tests was made to determine the residual stresses in pipe joints welded at three different temperatures when tested in the as welded, furnace stress relieved, and local stress relieved condition

Welded Joints in Carbon-Molybdenum Piping

DIFFICULTIES in welding, such as cracking and distortion, are usually associated with thermal stresses resulting from the sharp temperature gradient between the molten weld metal and the adjacent base metal.

Creep tests by the relaxation method have demonstrated that holding this material at 1100 to 1200 F for 1 hr per in. of thickness will greatly reduce the residual internal stresses.

By preheating and concurrent heating to a temperature of 300 to 500 F, the temperature gradient is less than when welding with the base metal at room temperature or below. It is logical to assume that with the lower temperature gradient, the magnitude and concentration of residual stresses will be less.

Experience has shown that preheating and concurrent heating is one of the best preventatives against cracking while stress relief annealing will not remove cracks once they are there. Preheating and concurrent heating have been found very beneficial in the development of welding procedures involving relatively thick sections, rigid structures, alloy steels and when welding structures in cold weather.

It is also possible that the residual stresses in a structure welded at the proper preheat and concurrent heating temperatures will be low enough so that stress relief annealing will be unnecessary. However, unless definite data are available, when in doubt it is wise to play safe by preheating, concurrent heating and also stress relief annealing.

The first series of tests showed that a preheating and concurrent heating temperature of 500 F produced satisfactory results as far as room temperature physical properties and soundness are concerned, but gave no information concerning residual stress.

The second series of tests, which were really pilot tests, was made to determine residual stresses in samples welded at three preheat temperatures when tested in (*a*) the "as welded" condition; (*b*) after stress relieving in a furnace; and (*c*) after local stress relief annealing.

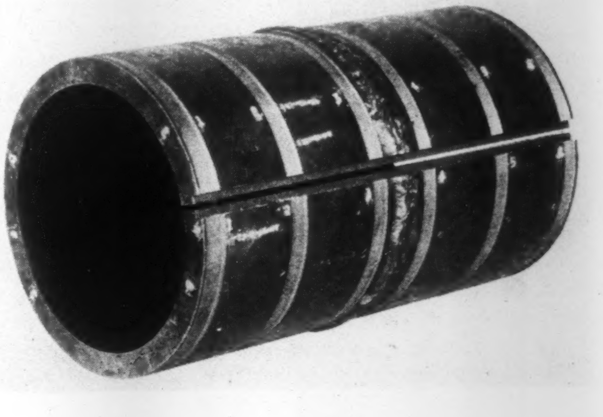
All pipe samples in this series were welded with the pipe in the vertical position because in this position a larger number of beads is required than when welding pipe in the horizontal position, with resulting higher residual stresses. The groove design used was Design No. 1 in Fig. 1 with the same welding conditions and procedure as in the first series, except for preheating and concurrent heating temperatures. Pipe sizes and composition were the same as in first series.

There were seven pipe samples; one without a weld, one welded at room temperature, one at 300 F, and four welded at 500 F. After welding, samples were radiographed.

Pipe samples S17-C13, 14 and 15, and S17-B16 which were 16 in. long when welded were machined as follows: The pipe samples were cut to a length of 15 in. and the ends were squared. Then they were laid out and the location of all specimens was properly marked.

Each sample was set in a boring mill, centered and six circumferential grooves ½ in. wide were machined just deep enough to clean up the surface. These grooves, shown in Fig. 11, provided location and satisfactory surface for measuring diameters. The diameters were measured and recorded at each groove and at the locations in each groove where longitudinal specimens were to be removed later. Next, samples were set up in a milling machine and a groove ¼ in. deep and ½ in. wide was milled the full length. The width of this groove was measured and recorded at seven points. The pipes were then split by saw cutting through center of

Fig. 11—Welded pipe sample used for checking residual strains. View showing sample with parts laid out and partly machined



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*Works Laboratory, General Electric Co.
Part 2.

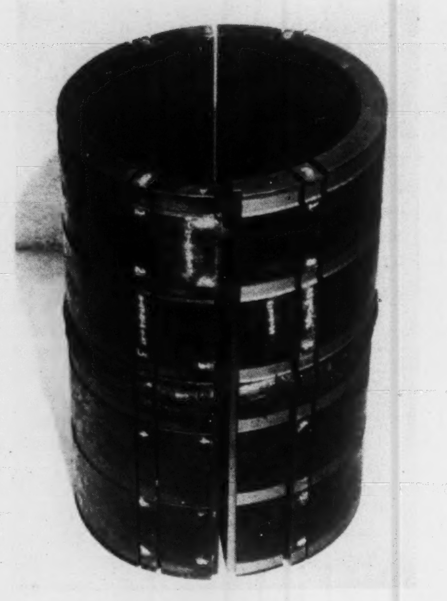


Fig. 12—Welded pipe sample used for checking residual strains. View showing sample completely machined and relative positions of longitudinal specimens

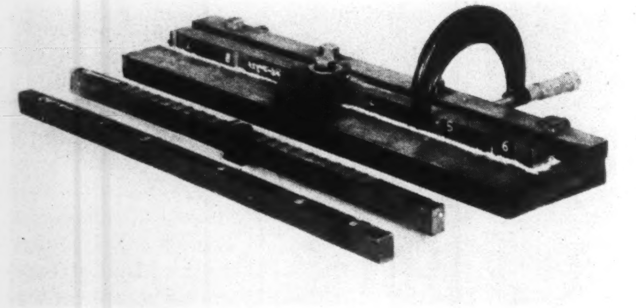


Fig. 13—Longitudinal specimen from arc welded pipe sample, located in jig for measuring deformation to check residual strains. Specimen in foreground is from unwelded pipe and other is from welded pipe

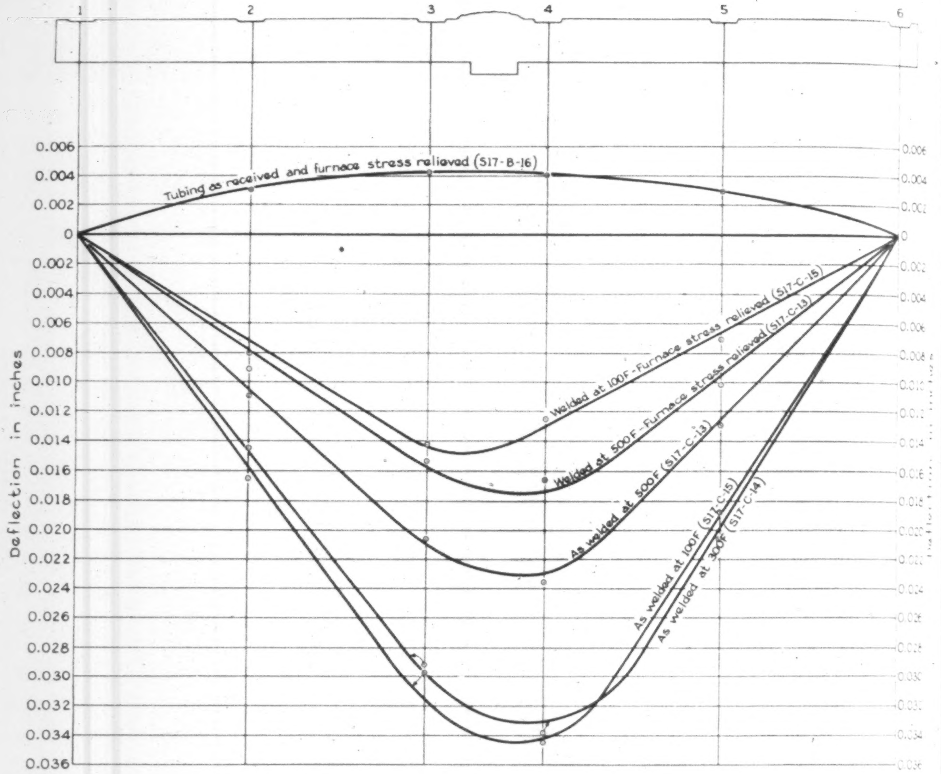


Fig. 14—Chart showing deflection curves of strips cut from pipes

longitudinal groove. The width of longitudinal groove was measured again at the same seven locations.

Each pipe was then cut in halves longitudinally, by saw cutting in Fig. 11. One-half of each pipe was then stress relief annealed at 1100 F in a furnace. Two longitudinal specimens ½ in. wide were removed by saw cutting from each half of each pipe sample.

Each longitudinal specimen was set up in a jig (Fig. 13) and measured at six points to determine the deflection at each point with reference to its original position as determined by the original diameter measurements.

The measurements of deflection of the longitudinal specimens are shown in Fig. 14. These measurements show the most deflection for the pipe welded at room temperature and tested in the "as welded" condition and a decreasing amount as the preheating temperature was increased.

The effect of furnace stress relieving was the greatest on specimens welded at room temperature and the least on specimens welded at 500 F.

The trend of results obtained by measuring the movement of the pipe after cutting through the wall longitudinally is the same as the trend of deflection measurements on the longitudinal specimens. All of the welded pipe samples opened up when split longitudinally in the "as welded" condition by the following amounts:

S17-C-15	0.09 in. open on pipe welded at room temperature
S-17-C-14	0.084 in. open on pipe welded at 300 F
S17-C-13	0.04 in. open on pipe welded at 500 F
S17-B-16	0.004 in. open at one end 0.008 in. closed at other end } on pipe sample without a weld

The results shown in Fig. 15 indicate that the bending took place in a relatively short length at the welded joint but the measurements were not taken close enough together to show the distance through which the bending took place or the shape of the bend.

At this point the last three of the seven pipes were welded at a preheating and concurrent heating temperature of 500 F. The length when welded of these three samples was increased to 30 in. The only difference in machining these three samples, as compared to the previous four, was an increase in the number of circumferential grooves for measuring diameters and deflections to give more points on the curve to determine the shape of the bend. The length of longitudinal test specimens was still maintained at 15 in.

S17-B-17 was a duplicate of S17-B-13 with only two longitudinal specimens in the "as welded" condition.

S17-B-18 was a check on both S17-B-13 and 17 in the "as welded" condition but with four longitudinal specimens instead of two.

S17-B-19 was the same as S17-B-18 except that the pipe sample

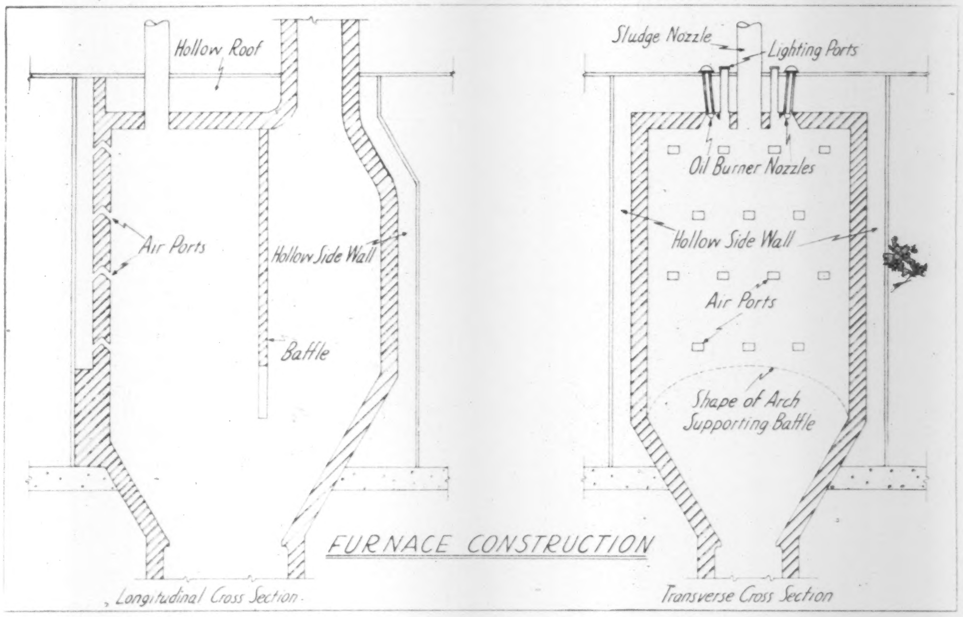
[Concluded on p. 773]

Handling and Burning Oil at Sewage Treatment Plant

By E. W. Mautner* and Kalman Steiner*

Practically every detail involved in the design and installation of the oil burners and accessory equipment for sludge incineration at the Calumet sewage treatment plant was novel in some respect. When the project was initiated, but little information was available on the design of such a system

AN unusual application of oil burners has been made at the Calumet sewage treatment plant of the Sanitary District of Chicago, where the burners are installed on the sludge incinerators. The sludge as fired contains about 20 per cent moisture, and just lacks sufficient combustibility to carry an unassisted fire. The entire incineration and heat recovery process has a thermal efficiency of 70 per cent; that is, of the total heat input of the sludge and fuel oil, only 30 per cent remains in the final stack gases, the rest being absorbed by the heat exchangers and used for sludge drying. At times, the sludge is not disposed of by incineration, but is converted into fertilizer. At such times, the oil burners are operated at high fires for the explicit purpose of generating hot gases for sludge drying only.



Description of Process

Sewage comes by gravity to the plant and is sent by pumps to the screen house, where it passes through mechanically cleaned screens, the solid matter thus removed being later ground and placed back into the main flow or routed to the sludge disposal plant. Next, the larger and partially suspended matter is removed in preliminary settling tanks and is sent directly to the sludge disposal plant; the remaining effluent is sent through the meter vault to the aeration tanks. There are 15 final settling tanks, each 91 ft square with rounded corners. The water depth is 15 ft 4½ in. at the center, giving a total capacity of 750,000 gal per tank at a settling rate of 1200 gal per sq ft per day. A center feed traction type circular mixer operates in each tank. Sludge is drawn off from the bottom by gravity through a 16 in. pipe, while the effluent escapes over a weir into 13 in. × 13 in. semi-elliptical conduit into the Sag Channel.

The total treatment time of the entire plant is approximately eight hours—10 to 40 minutes in the preliminary settling tanks, five hours in the aeration tanks, an average of slightly over two hours in the final settling tanks, and an additional 30 minutes for the sludge in the sludge disposal plant.

The sludge disposal plant reduces the activated sludge to inert ash in three steps: dewatering, drying, and incineration. Sludge from the final settling tanks is first mixed with ferric chloride which serves as a coagulating agent. It then goes to one of the four rotary drum type vacuum filters. Filter cake is taken on a conveyor system to the mixers, where a certain quantity of previously dried cake is added to the wet material to serve as an absorbent and to assist in pulverization. From the mixers the cake passes on to the dryers, of which there are three, each having a capacity of 190,000 lb of water per day. The drying is done by means of vapor in a closed system, the vapor being heated in a heat exchanger by stack gases from the incinerator furnaces.

The stack gases pass longitudinally through a portion of a slowly revolving drum where they give up much of their heat, emerging at 400 F. The heat is transferred to the vapors which are used for drying sludge, the vapors passing counterflow to the stack gases through the drum. The vapors, having served in the drying, carry certain odors, and so cannot be released directly to atmosphere. Instead, this vapor is forced into the incinerators to serve as secondary air in combustion. Here all odor is destroyed. The stack gases, having passed through the heat exchanger drum, then go through an electrical dust precipitator before escaping to atmosphere.

The dried sludge is removed from the drying system by means of a cyclone separator, part of it being returned

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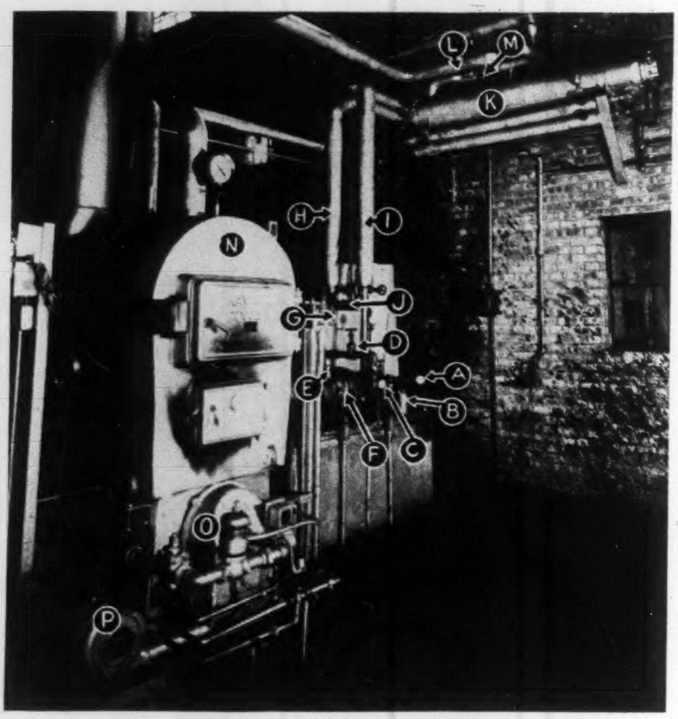
*Mid-West Heat Service Co., Combustion Engineers.


L
M
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F
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General view of oil handling equipment, and of the auxiliary steam boiler. The white sheet was hung up to aid in photographing

A, vacuum gage, tank side of suction strainer; B, suction strainer; C, vacuum gage, pump side of suction strainer; D, suction line valve, No. 1 pump; E, suction line to No. 2 pump; F, motor of No. 1 pump; G, pump motor starting stations; H, cold oil line to heater; I, hot oil line from heater; J, bypass around heater; K, oil heater; L, steam supply to heater; M, thermostatic steam valve; N, auxiliary steam boiler; O, combination oil and gas burner; P, blower for combination burner.

to the sludge mixer but most of it going to the sludge burners on the incinerator furnaces.

Three Incinerator Furnaces

There are three incinerator furnaces, one for each dryer. Two furnaces are sufficient for all requirements, but a third is necessary to allow for repairs and maintenance, as well as removal of slag. Two dryers, also, are sufficient for plant requirements, leaving a third for emergencies. One filter will usually provide for one dryer, with a third for spare, except for the fact that the filter cloth covering often becomes clogged, in which case three filters are required for two dryers and two incinerators.

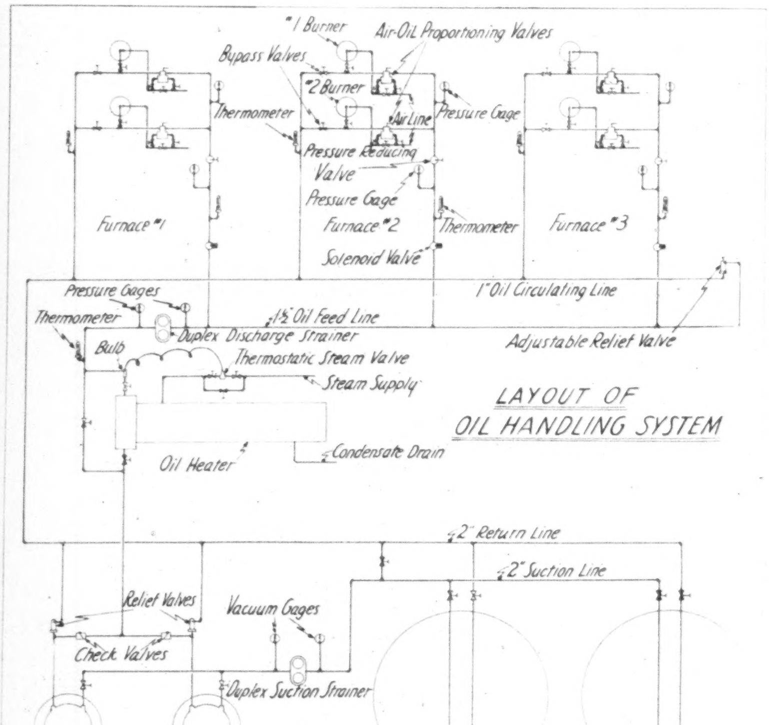
Before considering the sludge incinerating furnaces and their oil burners, it should be mentioned that these furnaces originally were equipped with pulverized coal burners, but for a number of reasons the pulverized coal did not prove satisfactory.

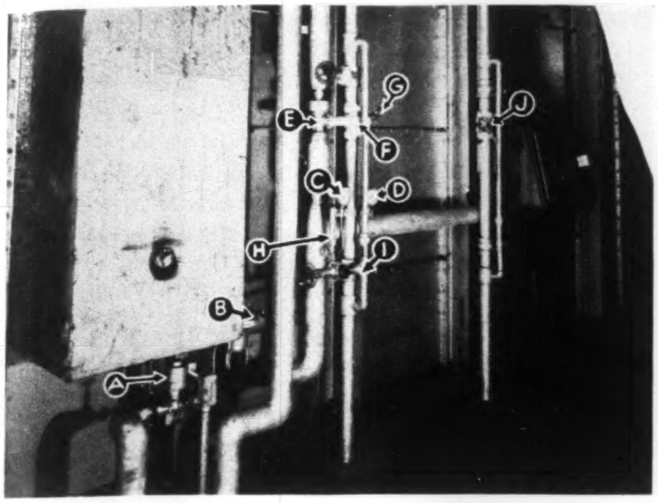
The following excerpt is taken from the specifications issued by the Sanitary District: "The contractor shall design, furnish and install a complete system for the handling, heating and burning of heavy fuel oil in the three furnaces in the sludge disposal plant. The system shall include underground storage tanks, with the necessary excavation and backfilling, fill piping, hot water piping, hydrostatic tank gages, oil piping, steam piping, including all cutting of holes, patching and pipe supports, oil pumps, oil strainers, relief valves, safety cut-off valves, necessary interlocking valves, oil heaters with automatic temperature control of steam, an auxiliary steam boiler with fully automatic gas-oil burner, domestic oil storage tank, gas piping, smoke pipe, draft regulator, thermal insulation, and piping. Drawings in sufficient detail to show the oil burning system proposed and the adaption of the same to the sludge disposal plant and its furnaces shall be submitted to the engineer and his approval obtained before any work is started."

Oil Storage and Piping

The underground oil storage comprises two 16,000 gal tanks, 9 ft 6 in. diameter by 30 ft long, with dished ends, which were set in place after the excavation was made and then completely enclosed in a 6 in. layer of limestone screening. After all pipe connections were made, backfilling was made to a depth of 3 ft above the tank top.

The tank accessories include, on each tank, one 18 in. and one 24 in. manhole, both with bolted covers, and both surrounded by concrete wells brought up to grade and topped with heavy square sewer covers; welded through the 24 in. manhole cover are one 2 in. suction stub and one 2 in. return stub, both extending down within 10 in. of tank bottom; also welded through the same manhole cover are one 1¼ in. hot water supply and one 1¼ in. hot water return; at the tank bottom, connected to the supply and return lines, is a hot water heating coil consisting of 150 lineal feet of 1¼ in. pipe formed into a coil 22 in. outside diameter with a 4 in. pitch lying horizontal in the tank with the connection end adjacent to the suction stub. All pipe connections


#1 Burner
Air-Oil Proportioning Valves
Bypass Valves
#2 Burner
Thermometer
Air Line
Pressure Gage
Pressure Reducing Valve
Pressure Gage
Furnace #1
Furnace #2
Thermometer
Furnace #3
Solenoid Valve
Pressure Gages
1" Oil Circulating Line
Thermometer
1½" Oil Feed Line
Duplex Discharge Strainer
Adjustable Relief Valve
Bulb
Thermostatic Steam Valve
Steam Supply
LAYOUT OF OIL HANDLING SYSTEM
Oil Heater
Condensate Drain
2" Return Line
2" Suction Line
Relief Valves
Vacuum Gages
Check Valves
Duplex Suction Strainer
Oil Pumps
Oil Tanks



Side view of one furnace at the operating floor level

A, solenoid oil valve; B, pressure reducing valve; C, pressure gage, high side; D, pressure gage, low side; E, oil proportioning valve, No. 1 burner; F, air proportioning valve, No. 1 burner; G, lever for operating proportioning valves; H, oil thermometer; I, air bypass valve; J, proportioning valve, No. 2 burner.

inside the tank were welded. Besides the manholes, other openings provided in the tank top were 2 in. vent flanges, 4 in. fill flanges, 2 in. measuring openings, and a 1 in. gage flange. All the piping was arranged so that the one manhole is free for ready access into the tank interior, while the other manhole cover carries all the internal tank piping, removable as a unit. The tanks set below grade adjacent to a railroad siding, and are filled through a 4 in. line which runs to the track side and can be connected to cars through flexible hose having swivel couplings. An oil strainer is placed in the larger manhole well; after passing through this strainer the fuel oil is valved into whichever tank is to be filled. Unloading is by gravity. Steam is brought to the siding for heating up the oil before unloading.

The tanks are situated at a considerable distance from the building. All piping from the building to the tanks is encased in insulated underground pipe tile having special pipe hangers and a drainage channel. In each larger tank manhole, each line carries a valve, so that only one line of each type need be carried from the building. Thus, the suction line from the pumps runs through the underground tile up to a tee situated close to the tanks. From the tee two separate lines issue, one for each tank and each in a branch tile housing all the lines to the individual tank. Inside the manhole well, the valves permit opening or closing off the separate tank from the main line, as desired.

It was required by the Sanitary District that the grade of oil to be burned by this system be No. 5. Under Bureau of Standards specifications, the viscosity of No. 5 fuel oil is permitted to range up to 800 Saybolt Universal seconds at 100 F.[1] The maximum burning capacity of each furnace was established at 110 gal per hr, and the oil circulating apparatus was designed on that basis. This affected the selection of pumps, heaters, burners, the design of the oil pumps and strainers, and size and layout of piping.

The pumps are of the internal gear type, running at 300 rpm, with v-belt drive from 1750 rpm squirrel cage, splashproof motors. Two pumps, each capable of handling the entire load, were installed. These pumps have to develop a suction lift of less than 10 ft, but must pull the oil through a total suction line length of about 175 ft. Discharge capacity is 750 gal per hr per pump; motor capacity is 1½ hp each.

Before entering the pumps, fuel oil passes through a duplex strainer having twin baskets and a three-way valve which permits cleaning either basket while the other is in use. The baskets are formed of perforated steel plate, the holes being 3/64 in. diameter. Vacuum gages on inlet and outlet show the drop through the strainer and serve as an index of the degree of fouling to warn the operators when cleaning is required. Similarly, on the discharge strainer, which is also duplex, but has 1/32 in. perforations, pressure gages before and after indicate the pressure drop, the differential increasing as the baskets accumulate sediment. The discharge strainer is situated after the oil preheater.

Between the pumps and discharge strainer is the fuel oil preheater. This is constructed as a multipass straight tube heat exchanger with steel tubes and steel shell. Oil passes through the tubes and steam at 15 lb pressure surrounds them. Steam admission is controlled in accordance with the exit oil temperature by means of a thermostatic steam valve having a remote bulb immersed in the oil stream and communicating to the valve through a capillary tubing. A three-valve bypass around the heater allows the operators to clean the tubes without shutting off the flow or interrupting operation.

At each pump discharge there is a pressure relief valve which will open at a predetermined maximum pressure and relieve oil back into the return line. The maintained line pressure is 35 lb.

The circulating line leaves the discharge strainer as 1½ in. pipe, and is carried a distance of about 100 ft in almost a straight line along the ceiling underneath the operating floor on which the oil pumping apparatus is set. At each of the three furnaces a branch line is taken off. After feeding the last furnace branch, the discharge main terminates in an adjustable pressure relief, the discharge from this valve really being the beginning of the return line. The setting of this adjustable valve determines the circulating oil pressure from the pump outlet up to this point. The return line constitutes the low side of the circulating system; it begins as 1 in. pipe, and as it runs back to the pumps it picks up the recirculating connections from each furnace. At the pump set the return line joins with the discharge from the relief valves at that point, and the combined return is then valved off separately into pump suction or tank return. Thus, the surplus oil gathered up at various points in the system can be directed at will either back into the pumps or returned to storage.

Each ½ in. furnace branch line from the circulating main rises up through the ceiling to a point about 4 ft off the operating floor. As the branch runs along the side of the furnace, the following equipment is attached: pressure gage to show circulating main pressure; solenoid oil valve controlled from the induced draft so that failure of any of the fans will shut off the oil feed; an oil line thermometer; a pressure reducing valve to bring down the oil pressure from 35 lb in the circulating sys-

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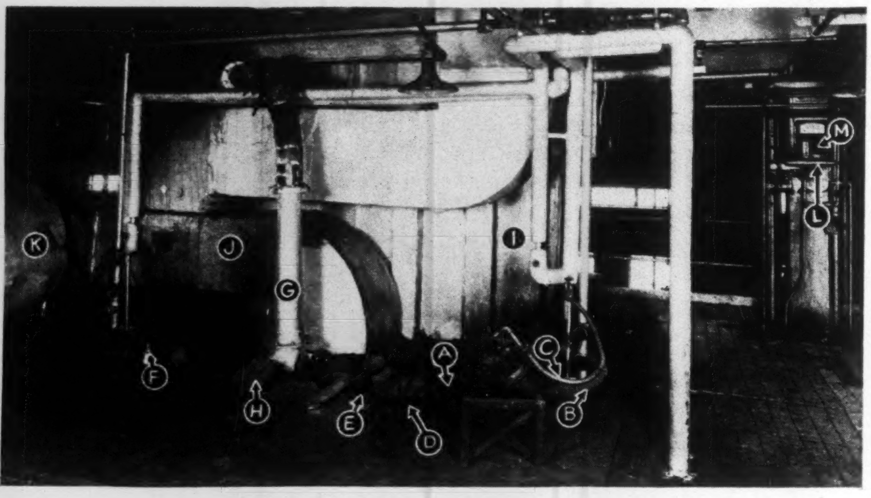
[1] Until a few months ago No. 5 oil was permitted a maximum viscosity of 2000 seconds S.U. at 100 F.



View of furnace at the firing deck level, on top

A, oil burner removed from furnace for inspection; B, flexible air connection; C, flexible oil connection; D, firing port for No. 1 burner; E, lighting port for No. 1 burner; F, No. 2 burner in firing position; G, sludge connection to sludge nozzle; H, observation port for sludge burner; I, uptake duct from furnace; J, heated air duct; K, one of the many circulating blowers; L, furnace draft controller; M, furnace draft gage.

tem to 18 lb for feeding the burners and overcoming the static head in lifting the oil about 20 ft up to the furnace top; another pressure gage; and finally two combination air-oil proportioning valves. The latter are connected to the air supply as well, and from these two valves the two air and oil feeds rise to the burners which are situated on top of the furnace. A bypass is installed around each air valve, so that a small amount of air will flow through the burner even when it is not firing. This air serves to cool the burner head, which otherwise might become excessively hot from reflected heat of the hot furnaces when the burners are shut off. The oil feeds are ½ in. and the air feeds 2 in.

Burners Fire Downward

Two burners are mounted on each furnace, and they fire downward through the furnace roof. Since they must be removable for inspection and cleaning, the final pipe connections are flexible on both the oil and air feed. Another bypass, on the oil, permits the operators to shunt cold oil into the return system when a cold burner is started up. As soon as hot oil reaches the burner the bypass is closed. A thermometer indicates the oil temperature at this point.

It should be noted that although the burners are mounted on the furnace top, the air and oil proportioning valves are situated near the operating floor level, for once the burners have lighted up it is much more convenient to regulate the fire size from the operating floor. Observation ports in the furnace wall permit viewing the fire while manipulating the proportioning valve from the operating floor.

The burners themselves are of the type known as medium pressure air atomizers. Air at 7 lb pressure is used for atomizing the fuel oil. Since it is desirable that at the burner tip both air and oil enter at about the same pressure, the oil handling system is arranged so that fuel being fed into the burner will be at 7 lb pressure also. Air is brought up to each proportioning valve in much the same manner as the fuel oil, the air main which runs along the back of the furnaces being 6 in. pipe, and each branch from main to proportioning valves being 2 in. pipe. From the valves the 2 in. air feeds rise to the burners on the furnace tops.

The transverse cross-section through one of the incinerator furnaces shows the construction details of the burner mounting. The sludge nozzle discharges vertically downward through the furnace roof. The roof is hollow, permitting circulation of air for the double purpose of cooling the refractory furnace lining and preheating air for combustion. The oil burners are set on opposite sides of the sludge nozzle, and are inclined slightly from the vertical so as to dip a few degrees toward the nozzle discharge. Thus the sludge nozzle, when operating, sends a long stream of burning sludge downward through the furnace, while the two oil burners project their fires in an almost parallel direction, but converging gradually into the sludge fire.

The Furnace Construction

The longitudinal cross-section of the furnace shows the baffle which divides the furnace interior into two vertical sections. In one section the three fires—one sludge and two oil—descend and consume the sludge material. In the other section the combustion gases ascend, being drawn upward by an induced draft fan, and leave the furnace at the top where they enter into the duct system which conducts the gases through the various apparatus which removes the available heat. The furnace bottom is hopper shaped, and serves to accumulate the inorganic ash which remains from the sludge disposal. This ash is removed by sluicing jets and conveyed to an ash sump or lagoon.

These figures also illustrate the furnace wall construction. It has already been mentioned that the furnace roof is hollow. It will be noted that all of the furnace walls are similarly constructed, and that a series of ports in the wall serve for the introduction of the air which has been preheated by circulating through the hollow walls and the hollow roof. In overall dimensions, the furnaces are about 12 ft transversely, 15 ft longitudinally, and 16½ ft high.

Regulation of Draft and Temperature

Aside from the rate of firing, which has already been described in conjunction with the air and oil proportioning valves near the operating floor level, the most important control factors are regulation of furnace draft and furnace temperature. It can well be appreciated that a furnace of such complicated construction must be watched carefully for avoidance of excessive temperature which would impair the refractory shape and strength. It has been found that 1800 F is the maximum safe furnace temperature. Draft at the furnace top in the first section, where the sludge and oil fires enter, is about balanced or atmospheric; at the furnace outlet into the duct system the draft is slightly below atmospheric. Draft is controlled by overfire regulators of the diaphragm type, which communicate impulses to the fan louvers in response to changes within the furnace interior. Furnace temperature is continuously recorded by recording pyrometers.

Introduction of air into the furnace is a very critical matter, the amount and direction having direct influence upon the effectiveness of the incineration. Any disturbance from the equilibrium conditions will cause such irregularities as carbon formation or clinkering. For example, a tendency toward carbon formation in the upper furnace corners was overcome by introduction of the vapors from the heat exchangers, previously mentioned, where sludge from the filter presses is dried.

Besides the six oil burners installed on the three incinerator furnaces described above, there is a seventh burner which can burn either fuel oil or gas. This burner is installed on a small steam boiler which produces steam during the summer for preheating the principal fuel oil supply of the main burners. This small unit burns No. 3 fuel oil, and a small auxiliary storage tank is provided to serve this burner. Actually, this unit usually burns gas, because during the summer the gas rate is lower than the oil cost would be. During the winter steam for the oil heaters is supplied from the main heating plant of the building. If required, however the small boiler can also run on fuel oil, and is available for emergency use should the heating plant or its boiler be shut down during the winter. Both are low pressure boilers.

Hot water from the large or small steam boiler is withdrawn by a small circulating pump and sent to the heating coils of the large fuel storage tanks. It will be recalled that each tank is equipped with a coil consisting of 150 lineal feet of 1¼ in. pipe. By pumping boiler water directly through the coils, the need for a heat exchanger is obviated.

Welded Joints in Carbon-Molybdenum Piping—

[Concluded from p. 768]

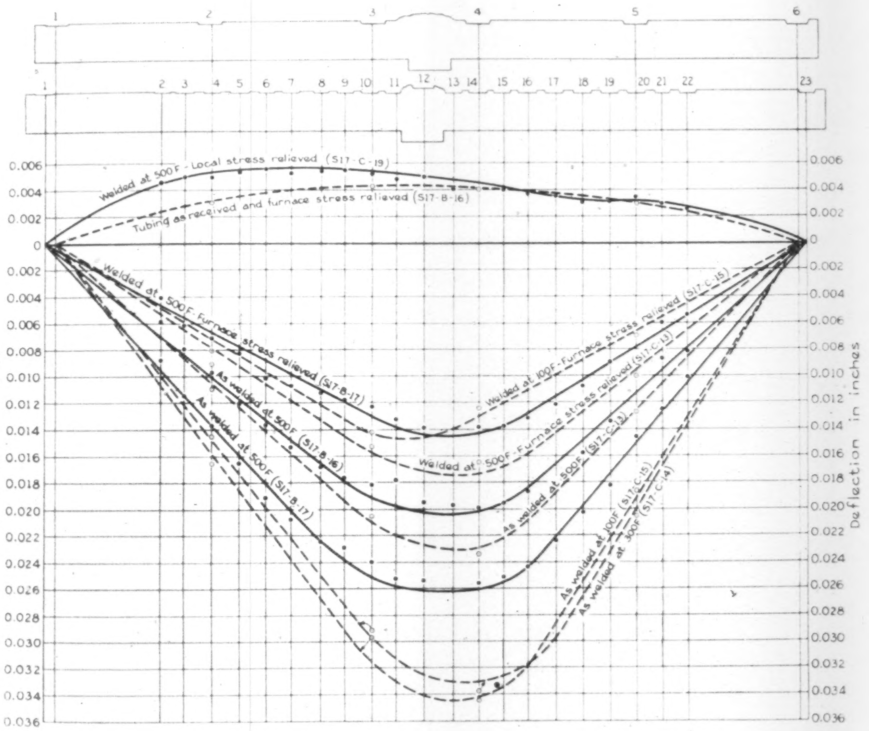


Fig. 15—Chart showing deflection curves of strips cut from pipes

was locally stress relief annealed giving four longitudinal samples for that condition.

After splitting the pipe samples longitudinally as previously described, it was found that they had opened up the following amounts:

S17-B-17 **0.055** in. open-checked in "as welded" condition.
S17-B-18 **0.06** in. open-checked in "as welded" condition.
S-17-B-19 **0.015** in. open-checked after local stress relieving.

The measurements of deflection of the longitudinal specimens taken from the seven pipe samples are shown in Fig. 15. The six curves shown by dotted lines are the same curves shown in Fig. 14. The four curves shown in solid lines show deflections of the longitudinal strips cut from the last three pipe samples welded. These solid line curves with the greater number of points show more definitely the shape and location of the bending.

Curves for specimens tested in the "as welded" condition and in the furnace stress relieved condition are of the same general shape. The curve for specimens welded at room temperature and tested in the "as welded" condition show the greatest deflection and the sharpest bend. While the three curves for specimens welded at 500 F and tested in the "as welded" condition show some variation in the maximum deflection, they have about the same shape and location of bend.

Curves for specimens welded at both 100 F and 500 F and furnace stress relief annealed are nearly identical and show less deflection and bend than similar specimens tested in the "as welded" condition.

The curve for specimens from the welded pipe after *local* stress relieving indicates that stress in the area around the weld has been apparently removed. However, the shape of the curve indicates that our specimens were not long enough to give a true picture of the stress condition resulting from the temperature gradients due to local stress relief annealing.

From a Field Engineer's Notebook

Methods of supporting piping under various conditions that can't always be foreseen in time for the plans and must be determined after inspection of the situation in the field

By **Allen M. Perry***

IN PLANNING construction or modernization of industrial and power plants, it is frequently impossible to indicate how all of the piping shall be supported due to various interferences which may arise. Frequently the type of supports must be determined by field engineers after inspecting the conditions.

The accompanying sketches, which have been taken from field notebooks and drawings, indicate various ways in which different conditions were handled on a large modernization project. Their value is chiefly to expedite special designs that must be fabricated quickly in the field. Examination will indicate that standard beam and pipe clamps fit into many of them, and that simple combinations of structural shapes and the use of welding expedite construction and installation.

Additional sketches are to be published in a future issue.

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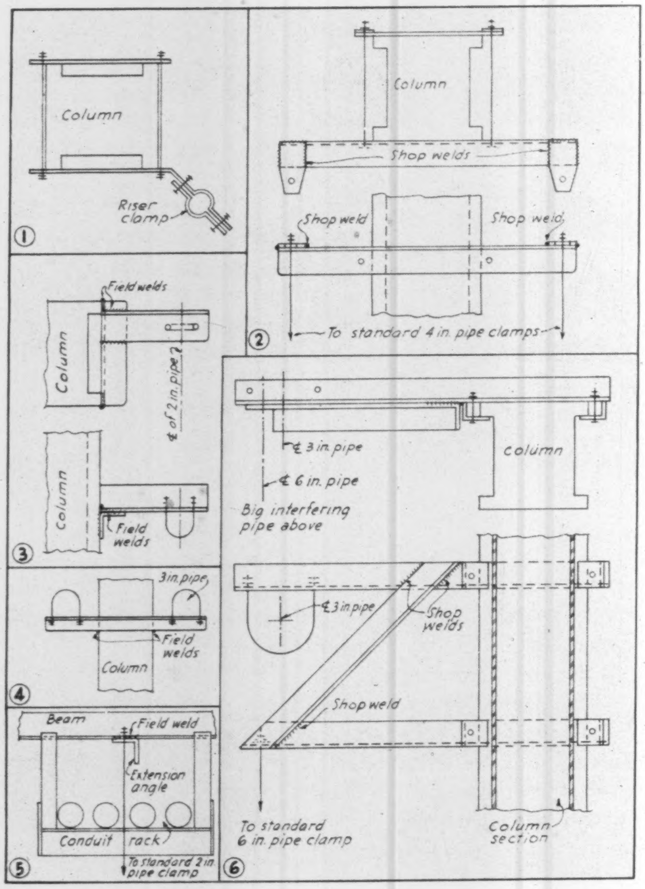
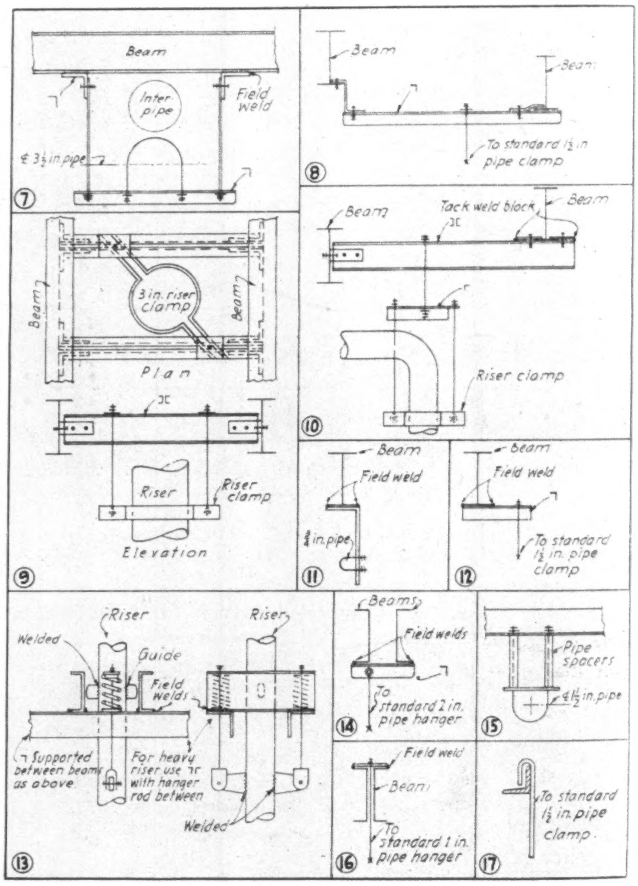
*Formerly with M. H. Treadwell Co., General Contractor.

Key to Finding Pipe Support for Various Conditions

Condition	Sketch Numbers Horizontal Runs	Risers
Between beams of same elevation	....	9-13
Between beams of different elevation	8	10
Near beam or platform	5-7-11-12-14-15-16-17	....
Near column	2-3-4-6	1-9
Interference above	5-6-7	10
Several pipes in same plane	4	....
Several pipes in different plane	2-6	....
Spring support or adjustment for position	....	13



Column
Riser clamp
①
Column
Shop welds
Shop weld
Shop weld
To standard 4 in. pipe clamps
②
Field welds
Column
℄ of 2 in. pipe
Column
Field welds
③
3 in. pipe
Field welds
Column
④
Beam
Field weld
Extension angle
Conduit rack
To standard 2 in. pipe clamp
⑤
℄ 3 in. pipe
℄ 6 in. pipe
Column
Big interfering pipe above
℄ 3 in. pipe
Shop welds
Shop weld
To standard 6 in. pipe clamp
Column section
⑥



Beam
Inter pipe
Field weld
℄ 3½ in. pipe
⑦
Beam
Beam
To standard 1½ in. pipe clamp
⑧
Beam
3 in. riser clamp
Beam
Plan
Riser
Riser clamp
Elevation
⑨
Beam
Tack weld block
Beam
Riser clamp
⑩
Beam
Field weld
¾ in. pipe
⑪
Beam
Field weld
To standard 1½ in. pipe clamp
⑫
Riser
Riser
Welded
Guide
Field welds
Supported between beams as above
For heavy riser use with hanger rod between
Welded
⑬
Beams
Field welds
To standard 2 in. pipe hanger
⑭
Pipe spacers
℄ 1½ in. pipe
⑮
Field weld
Beam
To standard 1 in. pipe hanger
⑯
To standard 1½ in. pipe clamp
⑰

$200,000 Award Program Indicates Possible Savings by Use of Welding

SAVINGS of $1,600,000,000 were indicated to be "available to industry by the wider application of arc welding" in the $200,000 award program recently sponsored by The James F. Lincoln Arc Welding Foundation. Three hundred and eighty-two papers were given awards in the various classifications into which the program was divided.

The papers receiving awards in the "Containers—Contents Moving," or piping, classification were those by R. C. Doremus, refrigerating engineer, George B. Bright Co.; Eric R. Seabloom, research welding engineer, Crane Co.; Sumner E. Perkins, chief mechanical engineer, Pioneer Div., Flintkote Co.; Howard Weiss, engineer, Dingle-Clark Co., and William Landsiedel, structural engineer.

Modernizing a Brewery

Mr. Doremus' paper discussed the modernization of the Stroh brewery, Detroit, with arc welded piping. All the former ammonia compressors, condensers and receivers were removed and replaced. All the old ammonia piping and steam piping mains were removed part by part along with removal of each machine it had served. Caps were arc welded on the ends of the mains and feeder branches while this work was going on, to permit the work to proceed while the remainder of the plant equipment handled the refrigeration load of the brewery. As each new compressor foundation was poured and prepared for a new machine, suction and discharge manifolds for double suction line connections were arc welded from standard welding fittings, and likewise planned for final assembly to its machine. Then one compressor and its engine at a time were set on the foundation, lined up and bedded in place.

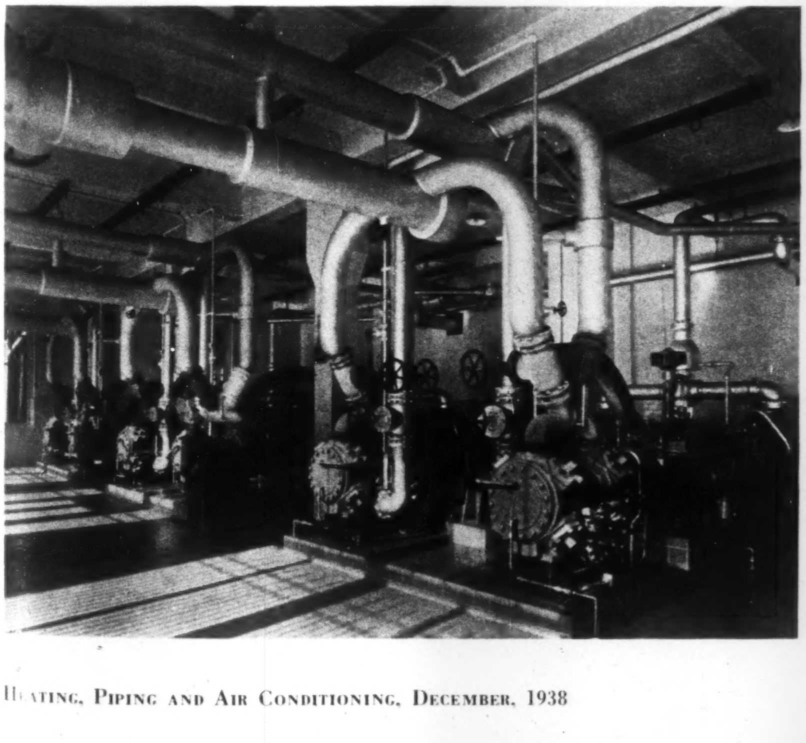
Besides the manifolds for the ammonia compressors, the remainder of the 5, 6, 8 and 10 in. discharge and suction piping connections had to be prepared. This ammonia piping was to conduct large volumes of ammonia vapor under various pressures from 10 in. vacuum to 200 lb, for there is also an ice cream manufacturing plant operated in connection with this brewery; it was essential that the piping be designed with broad sweeps and bends to avoid high pressure drops from sharp bends.

It is customary practice to equip each ammonia suction line with a suitable suction strainer to catch dirt and scale and prevent it from entering the compressor cylinders. This plant comprises three ammonia suction lines of different suction pressures connected with the seven new ammonia compressors, totalling 1000 tons of refrigeration capacity. It was considered best to make these strainers and strainer bodies large enough to accommodate two compressors on account of their twin arrangement. However, there were no such items of this size and capacity procurable as stock equipment from any manufacturer, so it was decided to make them of welded construction, using 12 in. steel pipe 48½ in. long, with a flange at the end to facilitate removing the strainer for periodic cleaning.

Fermenting Tank Attemperators

Fermenting beer wort generates heat which must be removed during the fermenting process to keep the wort at the desired bath temperature. This was done 40 years ago by "swimmers" or blocks of ice floating in copper pans or floats. In most of the present-day breweries this has been replaced by a copper coil in each fermenting tank, through which cold brine is circulated for refrigeration.

In the Stroh plant, it was decided to change the brine attemperators to flooded ammonia attemperators to avoid the possibility of brine leaks and spoilage and at the same time improve the plant efficiency by eliminating the two temperature differences in transferring the heat directly from the fermenting beer wort to the ammonia refrigerant. This called for steel construction suitable for ammonia use, for copper cannot be used with ammonia, and yet it had to be clean and sanitary and impossible to rust. The answer to this problem was 2½ in. heavy ammonia steel pipe



Some of the modernized brewery piping

The papers which received awards in the "Containers—Contents Moving" classification of the recent James F. Lincoln Arc Welding Foundation award program are reviewed here. . . . Because of space limitations, it is impossible to give more than a brief summary of the information contained in the authors' original papers

coils bent to shape, arc welded together in each tank and finally tinned on the outside by hand. These were fabricated accordingly in 155 fermenting tanks and connected together with welded ammonia branch and main piping connections in three mammoth flooded ammonia systems, for they are situated in three buildings, with automatic ammonia float control valves and accumulators also of welded construction. This is a revolutionary idea (according to Mr. Doremus) for, prior to the art of welding, brewery engineers and architects were loathe to use flooded ammonia coils submerged in tanks of fermenting beer wort on account of the danger of ammonia leaks spoiling the beer. However, this arrangement was made possible by welding and, so far as is known this is the only installation of its kind in the United States, if not the whole world. Later it was decided to equip four closed fermenting tanks with similar welded steel attemperator rings, but in this case 3½ in. O. D. 18-8 stainless steel tubes with ¼ in. thick wall were used, and these were similarly welded.

Cost of Welded Joints

A study was made of several joints of each size during the progress of the installation and the resulting cost is tabulated here.

The table does not include cost of trucking, bills of material, checking tally sheets, shortages, invoicing, checking invoices, power cost involved in welding, etc.

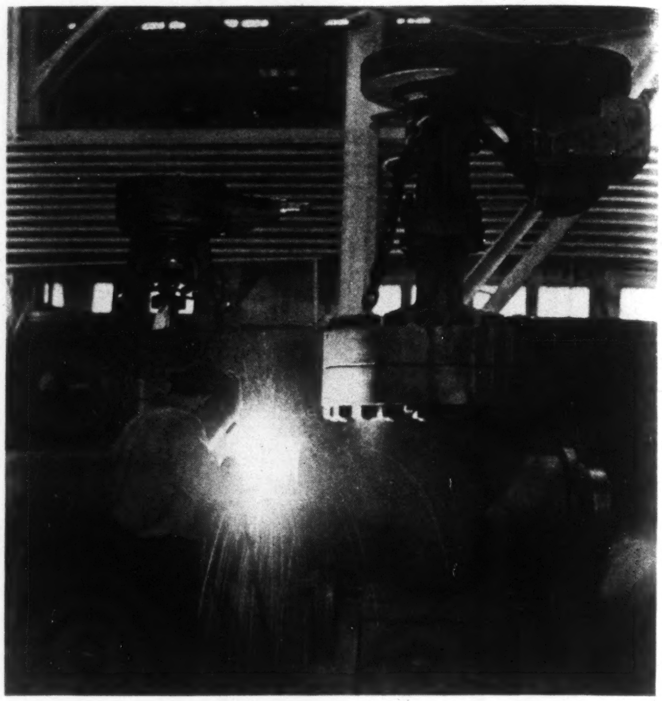
It was found that 2½ in. is the dividing line in pipe sizes in cost comparisons alone, and that 2 in. joints and smaller can be made at a lower cost with screwed joints than by welding. However, the other advantages frequently determine welding procedure notwithstanding a small difference in cost on small sizes.

High Pressure—High Temperature Valves

The paper by Mr. Seabloom was devoted to elimination of flange joints on high pressure-high temperature piping and valves by arc welding. With the increased pressures and temperatures in steam power plants, the savings effected are very pronounced, he said, as the sizes involved are usually quite large and flange joints become extremely heavy, costly, difficult to erect, and "practically impossible" to maintain tight for a reasonable period of time. While welding has been used for a certain amount of joints, including end flange connections of valves in some of the more recent plant additions and modernizations, it is possible to gain further advantages by welding the bonnet joints of valves. This has not yet been attempted on high pressure-high temperature service, he stated, but tests in progress indicate that arc welding, stress relieving and if necessary dismantling, rescarfing and rewelding of the bonnet joints can readily be accomplished without distortion of the valve seats.

Cost of Making Arc Welded Pipe Joints

Pipe Size, In.	3	4	5	6	8	10	12
Cut to length and scarfing	0.20	0.30	0.55	0.70	1.00	1.50	2.50
Assembly cost	0.57	0.57	0.82	1.12	1.42	1.88	2.25
Cost of weld	0.96	1.28	1.60	1.92	2.56	3.20	4.80
Aligning	0.32	0.43	0.53	0.64	0.85	1.07	1.60
Total	$2.05	$2.58	$3.50	$4.38	$5.83	$7.65	$11.15



A 14 in., 1500 lb gate valve being welded into a header. Note size of bonnet flange

Mr. Seabloom discussed creep problems, new alloy steels for welding, weldability of carbon-molybdenum steel, air hardening properties, flange joints and their problems, difficulties in pulling up bolts and creep problems with bolting, welding of valves, weight reduction by welding, and cost savings. He summarized his paper as follows:

"The welding of valves into piping, including the welding of the bonnet joints, particularly for higher pressures and temperatures, offers the real solution to the problems encountered with flange joints.

"As the stresses in welds are of the same magnitude as those of the pipe walls and relatively low in comparison to the stresses imposed upon flange joint bolting, creep is not an important factor. Consequently, the maintenance required on welds during the life period of the installation is practically *nil,* whereas flange joints require rather frequent and expensive servicing in order to maintain them absolutely tight.

"The pulling up of bolts when assembling the valves and installing them into pipe lines requires a great deal of manpower due to the high torques necessary on the wrench levers to properly stress the bolting and assure original tight joints. This operation is both tedious and

[Concluded on p. 781]

New and simple formulas are developed by the author for computing the final dry and wet bulb temperatures of the air leaving a coil. Particularly noteworthy is the fact that the final wet bulb depression of the air is shown to depend upon the initial wet bulb depression of the air for both direct expansion and counterflow coils. This makes computation of the final dry bulb temperature the work of a moment

Performance of Coils for Dehumidifying Air

By William Goodman*

IN order to understand the drawing of the condition curve by means of the second method mentioned in Part 1, which was published last month, the meaning of surface temperature and how it is computed must first be understood.

Surface Temperatures of Direct Expansion Coils

In coils used to cool and dehumidify air, the refrigerant flows through a thin walled metal tube of high thermal conductivity. Because of the thinness of the wall, and the comparatively high thermal conductivity of the metal, the temperature of both sides of the thin metal wall—that is, the temperature of both its surfaces—is substantially the same; the difference is negligibly small.

The surface temperature of any point on a coil can be found by means of the following equation, which is derived in Appendix 6,

$$\frac{h - h_S}{t_S - t_R} = \frac{cf_R}{Bf_g} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots [12]$$

The method of solving this equation for the surface temperature by means of Fig. 3 and Table 5 is described later.

For any given coil and any given air and refrigerant velocities, the right-hand member of [12] reduces to a constant. Inasmuch as the metal surface of the coil is wet, h_S, the enthalpy of saturated air, depends only upon the value of t_S, the surface temperature. Hence, for any given refrigerant temperature it is evident from [12] that the surface temperature t_S depends only upon the enthalpy h of the air flowing over the coil. However, the air is losing heat as it flows through the coil and, therefore, its enthalpy h is constantly decreasing. This being the case, the surface temperature of the metal must also be continually decreasing from the edge where the air enters the coil to the edge where it leaves. Interpreted practically, this means that the last row of tubes with which the air is in contact is colder than the preceding row, and that this row is in turn colder than the row ahead of it—in spite of the fact that the refrigerant temperature may be the same in all the rows of tubes.

Evidently from Equation 12, the temperature of a given point on a cold, wetted surface is always at some point between the wet bulb temperature of the air flowing over that point on the surface and the temperature of the refrigerant inside the coil. This will also be evident from the solution of Example 6 which follows.

In order to solve Equation 12 for the surface temperature corresponding to any desired wet bulb temperature of the air, first find the value of (cf_R/Bf_g), the right-hand member of Equation 12. Then by means of Table 5, find the angle θ, the meaning of which is illustrated in Fig. 4. Point *3* of this figure is located at the intersection of the given wet bulb temperature and the refrigerant temperature. A line is drawn through *3* at an angle θ with the vertical. The surface temperature for the given wet bulb temperature is read at the intersection of this line with the curve at point *4*. To find the surface temperature for a different wet bulb temperature, the center of the protractor is moved along the vertical line *1-2*, representing the constant refrigerant temperature, to the horizontal line representing the new given wet bulb temperature. This process can be repeated for as many different wet bulb temperatures as necessary. For example, to find the highest surface temperature on the coil, the slanting line should be drawn through point *1*, representing the initial wet bulb temperature of the air.

The construction of Fig. 3 and the computation of Table 5 are described in Appendix 6.

Example 6: Take the conditions of Example 1, and find the surface temperature when the wet bulb temperature of the air flowing over the coil is 65 deg.

Solution: From Example 1, $f_g = 12$, $f_R = 300$, $B = 17$, and $t_R = 42$ deg.

The right-hand member of Equation 12 is

$$\frac{cf_R}{Bf_g} = \frac{0.243 \times 300}{17 \times 12} = 0.357$$

Referring to Table 5, for $\dfrac{cf_R}{Bf_g} = 0.357$, $\theta = 57°\text{-}30'$.

Using the chart in Fig. 3, $t_s = 57.2$ deg.

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*The Trane Co. Member of Board of Consulting and Contributing Editors.

Part 2. Part 1 was published in HEATING, PIPING AND AIR CONDITIONING, November, 1938, pp. 697-701 and 707.

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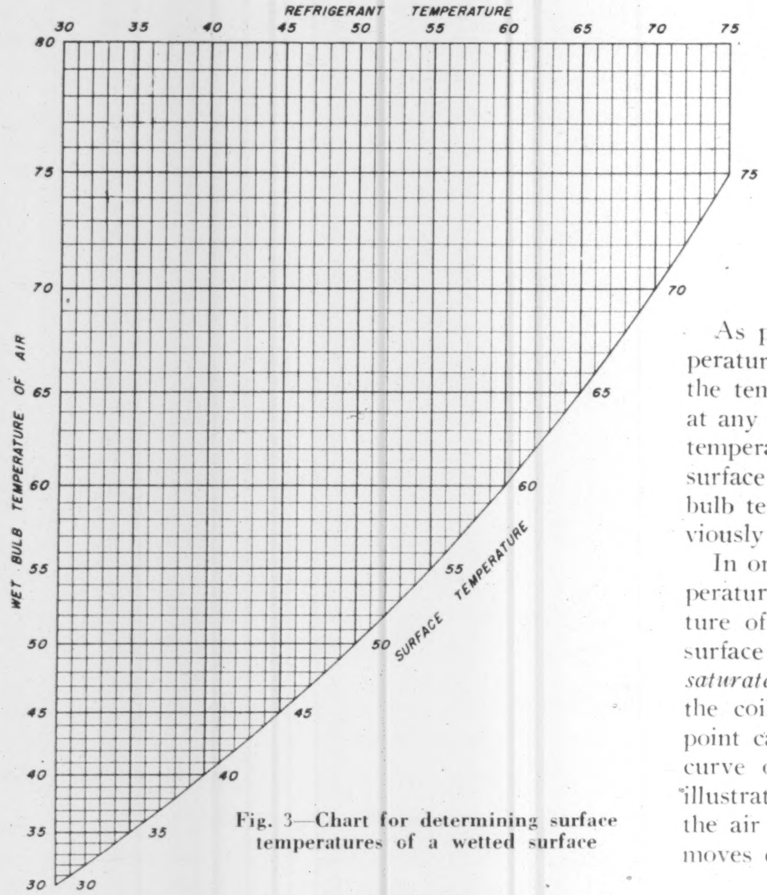

Fig. 3—Chart for determining surface temperatures of a wetted surface

Condition Curve for Direct Expansion Coils

An understanding of the condition curve is helpful because it provides a picture of the conditioning process, and also because it is useful for illuminating many other phases of the subject in subsequent portions of this article—phases which might otherwise remain obscure without the simple explanations afforded by the use of the condition curve.

As previously stated, the condition curve can be plotted on the psychrometric chart by two different independent methods. The first method has already been described. The second method is of interest not only because it serves as a check on the first method, but also because it illustrates the basic physical process involved in the cooling and dehumidifying of air by cold, wet surfaces.

The change in the condition of the air as it flows over a cold, wetted surface can be illustrated by considering the microscopically thin film of air in contact with the wetted surface. This thin film of air in contact with the surface is stationary even though the main air stream flows past the surface with a turbulent motion. Continuous mixing takes place between the moving air stream and the stationary surface film because the turbulent movement of the main air stream literally tears away portions of the surface film. Also because of this turbulent movement, infinitesimal portions of the main air stream are driven into the surface film to replace the portions of the film carried away. This mixing process takes place in addition to the processes of heat transfer and moisture diffusion.

Now if the air film in contact with the wetted surface is considered to be saturated, the temperature of this microscopically thin film of saturated air at any point on the surface is equal to the surface temperature of the metal at that point. Inasmuch as the surface temperature varies throughout the coil, the temperature of the saturated surface film also varies. Therefore, as the air to be cooled travels through the coil, it is constantly being mixed with colder air from the saturated surface film. This mixing process can be used to trace the condition curve on the psychrometric chart.

As previously stated, for a constant refrigerant temperature, the temperature of the surface and, therefore, the temperature of the stationary, saturated film of air at any point on the coil depends only upon the wet bulb temperature of the main air stream at that point. The surface temperature corresponding to these various wet bulb temperatures can be computed by the method previously described.

In order to draw the condition curve, the surface temperature corresponding to the initial wet bulb temperature of the air entering the coil is found first. This surface temperature represents the temperature of the *saturated* film of air in contact with the inlet edge of the coil. Therefore, the condition of the film at this point can be represented by point *A′* on the saturation curve of the psychrometric chart of Fig. 5. In this illustration, point *A* represents the initial condition of the air entering the coil. Now as the main air stream moves over an infinitesimally small area of surface, an

Table 5—Values of the Angle θ for Use with Fig. 3

$\frac{cf_R}{Bf_g}$	θ	$\frac{cf_R}{Bf_g}$	θ	$\frac{cf_R}{Bf_g}$	θ	$\frac{cf_R}{Bf_g}$	θ
0.00	90°— 0′	0.45	51°—14′	0.90	31°—54′	2.90	10°—56′
0.01	88°—59′	0.46	50°—37′	0.91	31°—37′	3.00	10°—35′
0.02	87°—57′	0.47	50°— 0′	0.92	31°—20′	3.10	10°—15′
0.03	86°—56′	0.48	49°—25′	0.93	31°— 4′	3.20	9°—56′
0.04	85°—55′	0.49	48°—50′	0.94	30°—48′	3.30	9°—38′
0.05	84°—54′	0.50	48°—15′	0.95	30°—32′	3.40	9°—21′
0.06	83°—53′	0.51	47°—41′	0.96	30°—16′	3.50	9°— 6′
0.07	82°—53′	0.52	47°— 8′	0.97	30°— 0′	3.60	8°—51′
0.08	81°—52′	0.53	46°—35′	0.98	29°—45′	3.70	8°—37′
0.09	80°—52′	0.54	46°— 3′	0.99	29°—30′	3.80	8°—23′
0.10	79°—53′	0.55	45°—32′	1.00	29°—15′	3.90	8°—10′
0.11	78°—53′	0.56	45°— 1′	1.02	28°—47′	4.00	7°—58′
0.12	77°—55′	0.57	44°—30′	1.04	28°—19′	4.20	7°—36′
0.13	76°—56′	0.58	44°— 0′	1.06	27°—51′	4.40	7°—15′
0.14	75°—58′	0.59	43°—31′	1.08	27°—25′	4.60	6°—57′
0.15	75°— 1′	0.60	43°— 2′	1.10	26°—59′	4.80	6°—39′
0.16	74°— 4′	0.61	42°—34′	1.12	26°—34′	5.00	6°—24′
0.17	73°— 7′	0.62	42°— 6′	1.14	26°—10′	5.20	6°— 9′
0.18	72°—11′	0.63	41°—39′	1.16	25°—47′	5.40	5°—55′
0.19	71°—16′	0.64	41°—12′	1.18	25°—24′	5.60	5°—42′
0.20	70°—21′	0.65	40°—45′	1.20	25°— 2′	5.80	5°—31′
0.21	69°—27′	0.66	40°—20′	1.25	24°— 8′	6.00	5°—20′
0.22	68°—34′	0.67	39°—54′	1.30	23°—19′	6.50	4°—56′
0.23	67°—41′	0.68	39°—29′	1.35	22°—32′	7.00	4°—35′
0.24	66°—49′	0.69	39°— 4′	1.40	21°—49′	7.50	4°—16′
0.25	65°—57′	0.70	38°—40′	1.45	21°— 7′	8.00	4°— 0′
0.26	65°— 6′	0.71	38°—16′	1.50	20°—29′	8.50	3°—46′
0.27	64°—16′	0.72	37°—53′	1.55	19°—52′	9.00	3°—34′
0.28	63°—27′	0.73	37°—30′	1.60	19°—18′	9.50	3°—22′
0.29	62°—38′	0.74	37°— 8′	1.65	18°—45′	10.00	3°—12′
0.30	61°—50′	0.75	36°—46′	1.70	18°—14′	11.00	2°—55′
0.31	61°— 3′	0.76	36°—24′	1.75	17°—45′	12.00	2°—40′
0.32	60°—16′	0.77	36°— 2′	1.80	17°—17′	13.00	2°—28′
0.33	59°—30′	0.78	35°—41′	1.85	16°—51′	14.00	2°—17′
0.34	58°—45′	0.79	35°—20′	1.90	16°—26′	15.00	2°— 8′
0.35	58°— 0′	0.80	35°— 0′	1.95	16°— 2′	16.00	2°— 0′
0.36	57°—17′	0.81	34°—40′	2.00	15°—39′	17.00	1°—53′
0.37	56°—33′	0.82	34°—20′	2.10	14°—56′	18.00	1°—47′
0.38	55°—51′	0.83	34°— 1′	2.20	14°—17′	19.00	1°—41′
0.39	55°— 9′	0.84	33°—42′	2.30	13°—41′	20.00	1°—36′
0.40	54°—28′	0.85	33°—23′	2.40	13°— 8′	25.00	1°—17′
0.41	53°—48′	0.86	33°— 5′	2.50	12°—38′	30.00	1°— 4′
0.42	53°— 8′	0.87	32°—47′	2.60	12°—10′	35.00	0°—55′
0.43	52°—30′	0.88	32°—29′	2.70	11°—43′	40.00	0°—48′
0.44	51°—51′	0.89	32°—11′	2.80	11°—19′	Inf.	0

infinitesimally small amount of the saturated air in the surface film is mixed with the main air stream, and *vice versa.* This mixing process can be represented on the psychrometric chart by a straight line drawn between points A and A'. The resulting condition of the mixture is represented by a point such as B which lies on the straight line connecting the two points. The actual location of point B on this straight line depends on the relative weights of air from the two sources present in the final mixture. The point representing the final condition of the mixture will, of course, lie closer to the point which represents the condition of the air that is present in greatest quantity in the mixture. In this case, as the weight of air from the surface film is infinitesimal in amount, point B can lie only an infinitesimally small distance from point A. The air has been cooled and dehumidified from point A to point B while flowing over this first infinitesimally small element of area. Therefore,

Symbols

A_{D} = external area of dry surface, sq ft.
A_{T} = total external area of coil surface, sq ft.
A_{W} = external area of wetted surface, sq ft.
B = ratio of external to internal surface area of coil.
c = humid specific heat of air (average $c = 0.243$).
d_{L} = large enthalpy (total heat) difference, Btu.
d_{M} = mean enthalpy (total heat) difference, Btu.
d_{S} = small enthalpy (total heat) difference, Btu.
D = wet bulb depression of the air, deg Fahr.
$D'' = t''_1 - t_{\mathrm{R}}$, or $t''_1 - t_{\mathrm{R}2}$
$D_{\mathrm{B}} = t_{\mathrm{B}} - t_{\mathrm{R}}$, or $t_{\mathrm{B}} - t_{\mathrm{R}2}$
D_{L} = large temperature difference, deg Fahr.
D_{M} = mean temperature difference, deg Fahr
D_{S} = small temperature difference, deg Fahr.
f_{S} = coefficient of heat transfer through air film, Btu per hr per sq ft per degree of temperature difference.
f_{R} = coefficient of heat transfer through refrigerant film, Btu per hr per sq ft per degree of temperature difference.
G = weight of air, lb per hr.
h = enthalpy (total heat) of humid air, Btu per lb of dry air.
h_{R} = enthalpy (total heat) of saturated air at temperature equal to the refrigerant temperature, Btu per lb of dry air.
h_{S} = enthalpy (total heat) of saturated air at a temperature equal to the surface temperature, Btu per lb of dry air.
H_{D} = total heat transferred through dry surface of coil, Btu per hr.
M = a numerical factor. See Equations 7, 11, and 24.
$R = \dfrac{Bf_{\mathrm{S}}}{f_{\mathrm{R}}}$
t = dry bulb temperature, deg Fahr.
t' = wet bulb temperature, deg Fahr.
t'' = dew point temperature, deg Fahr.
t_{B} = boundary dry bulb temperature, deg Fahr.
t'_{B} = boundary wet bulb temperature, deg Fahr.
t_{R} = refrigerant temperature, deg Fahr.
t_{S} = surface temperature of coil, deg Fahr.
U_{D} = over-all coefficient of heat transfer through dry surface of coil, Btu per hr per sq ft per degree of temperature difference.
U_{W} = over-all coefficient of heat transfer through wetted surface of coil, Btu per hr per sq ft per Btu of enthalpy difference.
θ = angle in Fig. 4.

Notes:

The subscript "1" refers to the initial condition of the air or refrigerant entering the coil. The subscript "2" refers to the final condition of the air or refrigerant leaving the coil.

All logarithms in formulas are to the base e.

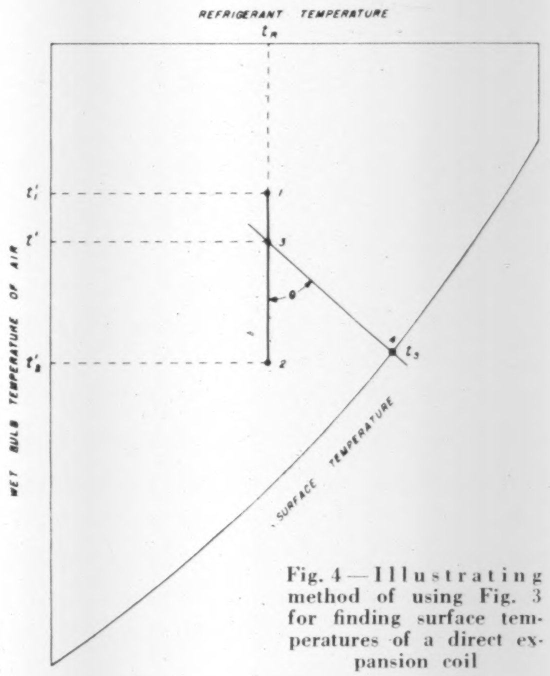

Fig. 4—Illustrating method of using Fig. 3 for finding surface temperatures of a direct expansion coil

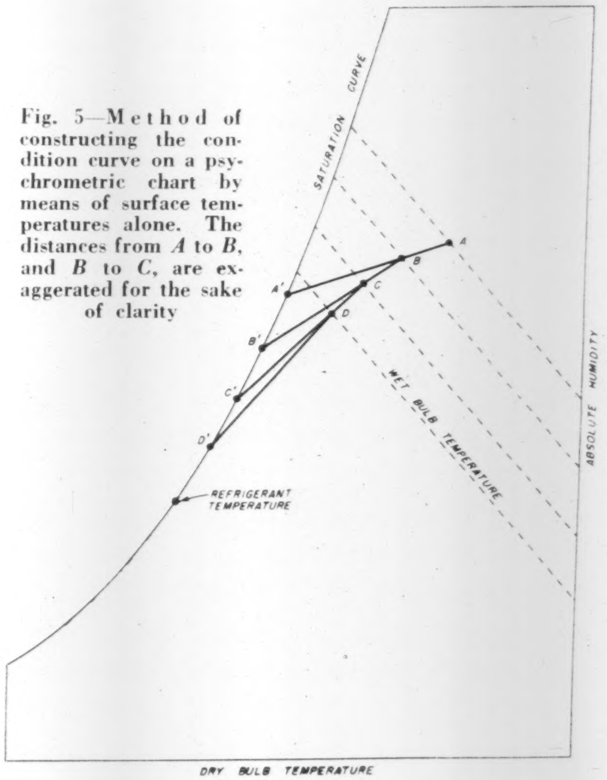

Fig. 5—Method of constructing the condition curve on a psychrometric chart by means of surface temperatures alone. The distances from *A* to *B*, and *B* to *C*, are exaggerated for the sake of clarity

point *B* represents the condition of the air leaving the first infinitesimally small area of the coil and approaching the second element of area.

If the surface temperature corresponding to the wet bulb temperature at point *B* is now found and located at point *B'*, a new line can be drawn between *B* and *B'*. Point *C* on this second line represents the condition of the mixture as it approaches the next infinitesimal element of surface area. In the same way this process can now be repeated by drawing the line between *C* and *C'*, and locating point *D*. For direct expansion coils, the condition curve ends on the saturation curve at a temperature equal to the refrigerant temperature. By drawing a sufficient number of these straight mixture lines in succession, the condition curve will be clearly outlined because it is the "envelope" of these lines.

For the actual work of drawing the condition curve by this method, finite changes in the condition of the air must be used. However, by making these changes sufficiently small, the actual condition curve can be obtained with a good degree of accuracy. For most practical work, point *B* of Fig. 5 need only be moved down a space corresponding to a change in wet bulb temperature of about one-half degree, although naturally the smaller this interval is made, the more accurate will be the resulting condition curve.

If the wet bulb temperature of the air leaving a coil has been computed by means of Equation 1, then the dry bulb temperature of the air can be read on the condition curve at the point where the computed final wet bulb temperature intersects the condition curve. However, the final dry bulb temperature can also be found by means of Equation 8. When the final dry and wet bulb temperatures of air leaving coils of different surface areas have been computed by Equations 1 and 8, and these points are then plotted on a psychrometric chart, they will usually fall very close to the condition curve drawn by the method described above, and frequently the two curves will coincide.

Boundary Dry Bulb Temperature of Direct Expansion Coils

All of the preceding discussion has been based on the assumption that the entire surface of the coil will be covered with a thin film of moisture condensed from the air. However, under some conditions, dehumidification of the air cannot begin until after the air has penetrated some distance through the coil.

Those who have had opportunities of examining coils under various operating conditions have probably seen coils that were dry on their inlet face as far as the eye could penetrate into the coil, and literally raining water from their outlet face where the cold air was leaving the coil. This is due to the fact that no dehumidification of the air can take place until the surface temperature of the coil has been lowered to a point below the initial dew point temperature of the air. Moisture drips from the cold surface of a glass pitcher of ice water only because the glass has been chilled to a temperature lower than the dew point temperature of the surrounding air. If the air is in contact with metal whose temperature is higher than the dew point temperature of the air, obviously no condensation of moisture can take place even though the dry bulb temperature of the air will be lowered by the cold metal.

As is evident from Equation 3 in Appendix 7, the temperature of a point on the dry surface of a coil will be at some point between the dry bulb temperature of the air flowing over the coil and the refrigerant temperature. Inasmuch as the dry bulb temperature of the air falls as it flows over a dry coil, the surface temperature of the coil must also fall in the direction of air flow. If the dry bulb temperature of the air is very high, the surface temperature will also be correspondingly high, and, as a result, the surface temperature of the metal may be higher than the initial dew point temperature. This is true in spite of the fact that the refrigerant temperature may be considerably lower than the dew point temperature of the air. The air may be hot enough to prevent the refrigerant from cooling the metal surface to a temperature that is lower than the dew point temperature of the air. Therefore, before dehumidification of the air can take place in the coil, the dry bulb temperature of the air must be lowered to such a point that the surface temperature can be kept below the initial dew point temperature of the air.

When drawing the condition curve on the psychrometric chart, the condition of the air flowing over the dry part of the coil is represented by a horizontal line drawn from point *A* to point *B* in Fig. 6 because no condensation of moisture takes place until the boundary is reached. The dry bulb temperature through the point marked *B* is called the boundary dry bulb temperature because it is the dry bulb temperature of the air when it flows over the imaginary boundary line between the dry and wet portions of the coil. From point *B* onward the curve drops as the air is dehumidified by the cold surface.

The following equation derived in Appendix 7 is used

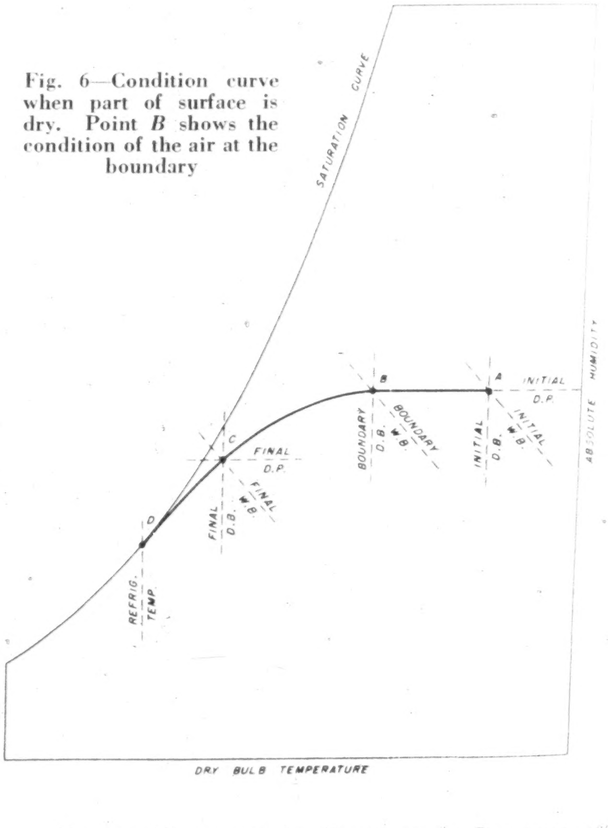

Fig. 6—Condition curve when part of surface is dry. Point *B* shows the condition of the air at the boundary

to find the boundary dry bulb temperature of the air flowing through a direct expansion coil.

$$D_B = \left(1 + \frac{1}{R} \right) D'' \qquad [13]$$

or

$$t_B = \frac{1}{R} (t''_1 - t_R) + t''_1 \qquad [13a]$$

where

$$R = \frac{Bf_g}{f_R}, \text{ or } \frac{1}{R} = \frac{f_R}{Bf_g} \qquad [14]$$

$$D_B = t_B - t_R \qquad [15]$$

$$D'' = t''_1 - t_R \qquad [16]$$

If the initial dry bulb temperature of the air entering a coil is *higher* than the boundary dry bulb temperature found by Equation 13 above, part of the coil will be dry. On the other hand, if the initial dry bulb temperature of the air is equal to or *lower* than the boundary dry bulb temperature, the entire surface of the coil will be wet; there will be no dry surface.

Example 7: Air at an initial dry bulb temperature of 98 deg and a wet bulb temperature of 72 deg is to be cooled in a direct expansion coil. The temperature of the refrigerant is 42 deg. For this coil, $f_g = 12$, $f_R = 300$, and $B = 17$. Find the boundary dry bulb temperature.

Solution: For an initial dry bulb temperature of 98 deg and a wet bulb temperature of 72 deg, the dew point temperature as found on a psychrometric chart is 59.5 deg.

By Equation 14, $\frac{1}{R} = \frac{300}{17 \times 12} = 1.47.$

By Equation 13a, $t_B = 1.47\ (59.5 - 42) + 59.5 = 85.2$ deg.

In this case the dry bulb temperature of the air must be lowered from 98 deg to 85.2 deg before the surface temperature of the coil will be lower than the initial dew point temperature of 59.5 deg. In other words, dehumidification of the air cannot take place until the dry bulb temperature of the air has been lowered to 85.2 deg.

The initial condition of the air entering the *wetted portion* of the coil is point *B* of Fig. 6; *not* point *A*. The dry bulb temperature of the air at point *B* is calculated by means of Equation 13. The boundary wet bulb, that is the wet bulb temperature at point *B*, can then be read either from the psychrometric chart or it can be computed by subtracting the sensible heat of each pound of air from the initial enthalpy of the air at point *A*. After point *B* has been reached, the balance of the computations are carried out in exactly the same way as illustrated by the preceding examples. The only difference is that the initial condition of the air entering the *wetted* coil is at point *B* instead of at point *A*.

[To be continued]

Savings by Welding—

[Concluded from p. 776]

often hazardous. Although arc welding of heavy valve and pipe sections is also time consuming, it requires only a welding operator and his helper to complete the assembly after the parts are properly aligned.

"The adoption of valves having all joints welded effects an enormous saving in weight amounting to approximately 50 per cent over flanged valves, including their companion flanges and bolting members. This weight reduction also makes it possible to exercise economies in pipe hangers and structural supporting members in a piping installation. Furthermore, heat insulation is more easily applied to welded joints in comparison to flanged joints as it is continuous; consequently, additional savings result.

"The cost of welded valves, as installed in a piping system, will eventually be less than flanged valves, when the demand is sufficient to build proper equipment for their economical production."

Paper Board Machine

The paper by Mr. Perkins described the use of welded piping for a seven cylinder paper board machine for the manufacture of miscellaneous box boards; threaded pipe was used only for sizes 2 in. and smaller. He presented complete tabular data comparing the welded construction with other methods of installing the piping.

Mr. Weiss' paper was devoted to the water piping system for the air coolers used in a slabbing mill which supplies slabs for a new continuous strip mill being built by Carnegie-Illinois. He discussed the function of the piping, the factors to be considered in its design, and compared designs for a flanged installation and a welded job. In his summary, he stated that the arc welded piping installation offered a 15 per cent reduction in friction loss, a 46.8 per cent reduction in cost of labor and material for joints and fittings, 15.9 per cent reduction in labor hours, 124 fewer gasketed joints to maintain, flexibility in design, and other miscellaneous benefits. The contract was let in May of this year as an arc welded job with flanged valves.

Compressed Air Header

Mr. Landsiedel's subject was the design of a main air header for carrying large volumes of compressed air at low pressures in connection with the extension of a sewage purification plant at Milwaukee. The design selected was an arc welded stainless clad steel main header. He gave tabulated cost comparisons of the header as built with other types of constructions which were also considered, and summarized the advantages of the welded header as decreased cost of erection through the use of lighter materials which are easier to manipulate, possibility of installation of the header in a much smaller space, and the lower weight, which in the case under consideration avoided overloading existing foundations.

Moisture Control by Liquid Absorption Offers a Useful Air Conditioning Tool

An interview with F. M. Johnson*

CONTROL of the moisture content of air by the liquid absorption principle, using a water solution of lithium chloride as the absorbent, is a useful tool of the air conditioning engineer which is finding many applications in both comfort and industrial process work. In a salt solution, the vapor pressure is a function of both concentration and temperature; an increased concentration at constant temperature or a decreased temperature at constant concentration effects a decreased vapor pressure. Thus, by bringing the air to be treated into intimate contact with the lithium chloride solution in some form of a contactor, the air will be dehumidified if the solution vapor pressure is below that of the air-vapor mixture, and will be humidified if the solution vapor pressure is above that of the air-vapor stream.

The vapor pressure of the solution is controlled definitely by controlling the solution temperature, determined by whether dehumidification or humidification of the air is required. Thus, the vapor pressure and consequently the relative humidity of the air is under definite control. During dehumidifying service, the relatively weak solution leaving the contactor flows to a sump tank (see diagram). Local recirculation from the sump tank to the concentrator, which is supplied by steam from a small gas fired boiler or from the regular steam lines of a plant or building, provides for highly concentrating a small portion of the total solution, after which it is returned to the sump. The moisture removed from the solution in the concentrator is carried away by a small amount of untreated outside air which is exhausted to atmosphere. A solution cooler, which is a heat interchanger through which well water or tap water is circulated, is provided in the solution circuit to control its temperature.

For humidifying service, the solution vapor pressure is increased by raising the solution temperature by providing the necessary heat. In this cycle, the local recirculation through the concentrator is closed and steam is supplied to the sump, steam being used because of its purity and the latent heat obtained from its condensation. In this way, the water which the solution has given up to the air stream in the contactor unit to humidify the air, is replaced in the solution in the sump tank.

The lithium chloride cycle controls only the moisture content of the air being treated, and the steam or fuel consumption for concentrating the solution follows the moisture load rather closely, decreasing in proportion to the amount of latent heat removed from the air. The temperature of this air is controlled by its flowing over heating or cooling coils in the regular way. However, the air need not be dehumidified by reducing its temperature below the dew point, which means that higher temperature water than would otherwise be satisfactory can be circulated through the coils. This is of advantage, as frequently well water or tap water at a low enough temperature is available at small cost. Also, it is believed that by operating with dry coils rather than wet, that odors in the conditioned space are in many cases minimized, as the constituents in the air of an occupied room which cause odors are not condensed on the coil surfaces.

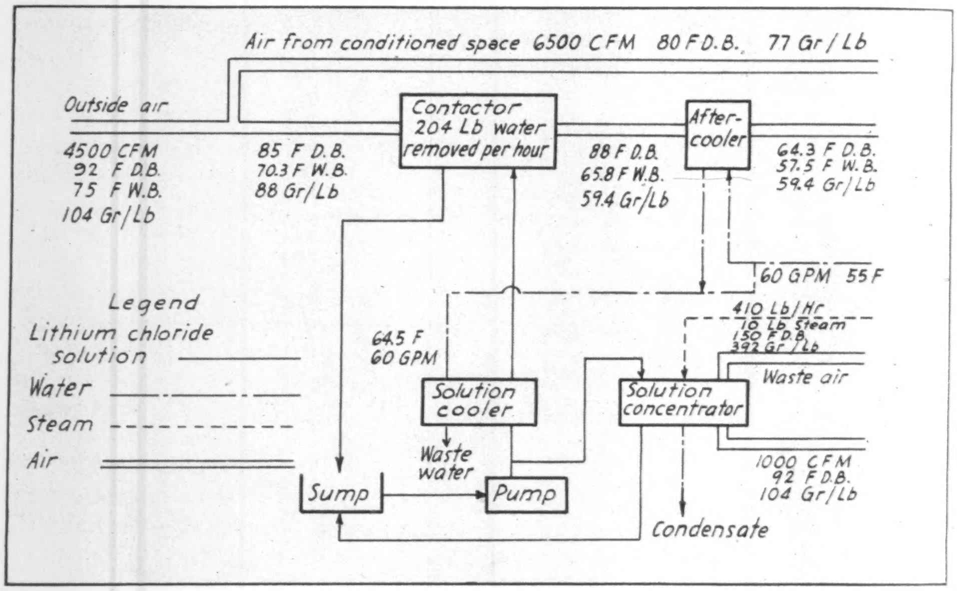

Diagram of a typical lay-out

Briefly, therefore, air conditioning by this method is based on the principle that at a certain density, and with a certain temperature, the lithium chloride solution has a definite vapor pressure. When air is brought into contact with the solution, the vapor pressures of the air and the solution tend to equalize, with a consequent exchange of moisture in one direction or the other, depending upon the relative vapor pressures. As it is practical to vary the vapor pressure of the solution by either changing its temperature or changing its density, it is possible to change the vapor pressure of the air—inde-

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*Air Conditioning Div., Surface Combustion Corp.

The method of dehumidifying and humidifying air to control its relative humidity within definite limits by means of the liquid absorption principle is described briefly. . . .An application in a Cellophane printing plant, and a typical arrangement for comfort air conditioning in large buildings, are discussed

pendently of the initial condition of that air—which is to be treated. As an example, if air at an entering condition of 80 F dry bulb, 75 F dew point, 80 per cent relative humidity and 131.4 grains of moisture per lb of dry air, with a vapor pressure of 0.87 in. of mercury, is passed over a lithium chloride solution at 80 F temperature, 1.270 density at 75 F temperature and vapor pressure of 0.153 in. of mercury, the leaving air at about 80 F will have a vapor pressure of 0.153 in. of mercury, which is approximately a 29 F dew point and 15 per cent relative humidity.

Where the temperature of the treated air, as well as its relative humidity, is important—as with all comfort installations and most industrial process jobs—the air after dehumidification by the lithium chloride solution is cooled by coils through which is circulated relatively high temperature water; say 60 F water. As indicated in the diagrammatic layout of a typical installation reproduced here, the water from this aftercooler is re-used in the solution cooler. On an industrial drying job where the treated air temperature may be high with no objection, this aftercooler might be omitted.

Comfort Air Conditioning in Large Buildings

One arrangement for comfort air conditioning in large buildings utilizes control of the moisture content of the air by the lithium chloride method to simplify the balancing of the sensible and latent loads, control of the various zones, and the handling of the outside air. In this scheme, all of the outside air is dehumidified by the lithium chloride solution and this air at low humidity is conveyed through small ducts to individual coolers in the various spaces which do all of the sensible heat removal but none of the latent heat removal. In winter the outside air is preheated and is then humidified, the humidified air being supplied to the individual units, which in winter are arranged to heat rather than cool the locally recirculated air.

In one typical layout of this kind, 30,000 cfm of outside air at 95 F dry bulb, 78 F wet bulb, and 118 grains per lb enters the dehumidifier where 1278 lb per hr of moisture is removed. Six thousand cfm of this dehumidified air at 99 F[1] dry bulb, 67.8 F wet bulb and 51.7 grains per lb is supplied to each of five local cooling units in the various areas or on different floors of the building. Each of these local units handles 20,000 cfm, 6000 cfm of which is the dehumidified outside air, and 14,000 cfm is recirculated air. The recirculated air at 80 F dry bulb, 66.3 F wet bulb, and 75 grains per lb mixes with the 6000 cfm of dehumidified air to result in a mixture at 85.7 F dry bulb, 66.8 F wet bulb, and 68 grains per lb entering each local unit. The 20,000 cfm of air from each unit to the conditioned spaces is cooled to a temperature of 66 F dry bulb, 60 F wet bulb, and has a moisture content of 68 grains per lb.

In winter, the 30,000 cfm of outside air at 0 F dry bulb and 5 grains per lb is first preheated to 60 F dry bulb, 40 F wet bulb, and then goes through the moisture control unit, where 782 lb per hr of water is added and the air is further heated so that the air supplied to the local units is at 68.5 F dry bulb, 55.6 F wet bulb, and has a moisture content of 45.5 grains per lb. The 14,000 cfm of recirculated air handled by each of the local units mixes with 6000 cfm of the humidified outside air, and the mixture enters each local unit at 73 F dry bulb, 55.3 F wet bulb, and 37.5 grains per lb moisture content. The 20,000 cfm air leaving the local units and supplied to the conditioned spaces is heated to 120 F dry bulb, 71.4 F wet bulb, and of course still has a moisture content of 37.5 grains per lb.

With such an arrangement it is possible to use small uninsulated ducts, as only outside air is necessary for ventilation and odor control is handled by the central humidifier-dehumidifier unit, and the air leaving this unit is at about the same temperature as it was when it entered. The local units consist of fans, coils and filters and may be cooled with well water, chilled water, or direct expansion. No dehumidifying is done by the local units, so provisions for taking care of condensation are unnecessary. In winter, they may be direct fired or heated by hot water or steam. Since the condition of the air rather than its volume is changed, the problem of control is simplified.

If desirable, the concentrator equipment can be situated in the basement of a building, from which the lithium chloride solution can be pumped to one or more contactor units in other parts of the structure.

Conditioning a Cellophane Printing Plant

An example of the application of the lithium chloride system to an industrial air conditioning problem where temperatures and humidities must be controlled within close limits is offered by the new windowless press room of the Shellmar Products Co. at Mt. Vernon, Ohio. The company specializes in printing on Cellophane, and because of the effect of temperature and humidity on the Cellophane and the inks used, the temperature is held at 80 F and the relative humidity at 45 per cent, 24 hours a day, winter and summer. In intermediate seasons, both humidification and dehumidification may be required alternately on the same day, and the conditioning system is controlled to switch from one service to the other automatically as required.

The new press room—in which nine presses will ultimately be installed—is one story high with an insulated roof; instead of windows, it has glass block panels. A particularly interesting thing about this structure is that by using the windowless construction it was possible to build the building and install the air conditioning system for less than $5000 more than a building of conventional sawtooth construction, but without air conditioning, would have cost. The owners had originally decided to build a conventional building with skylights and windows and add air conditioning at some future date. Fortunately, before construction was started, it was found that the savings with windowless construction would make possible present purchase of the air conditioning equipment with an expenditure of but $5000.

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[1] The air is heated slightly because the vapor removed from it has given up latent heat of condensation.

The press room, shown in one of the photographs, is 220 ft long by 80 ft wide and has a ceiling height of 14 ft. A rather large amount of outside air, 10,000 cfm, is used as it is necessary to prevent concentration in the room atmosphere of volatiles from the inks which are used because of the possibility of forming an explosive mixture and to provide better conditions for employees.

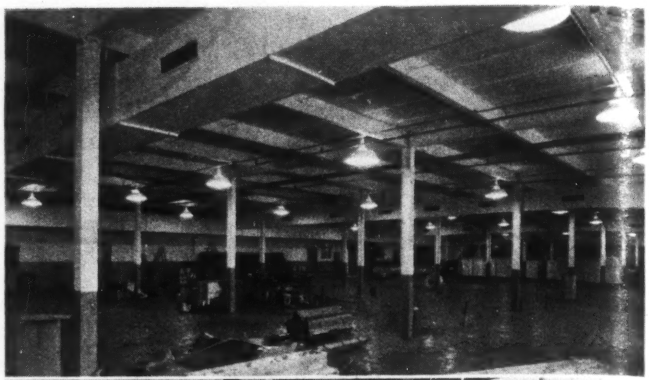
This outside air is dehumidified during the summer cycle (and humidified when humidification is required) in a cell type lithium chloride contactor unit, is then cooled by an aftercooler coil through which well water is circulated, and is then mixed with 38,000 cfm of return air which has been filtered and cooled by coils through which the same well water is also circulated.

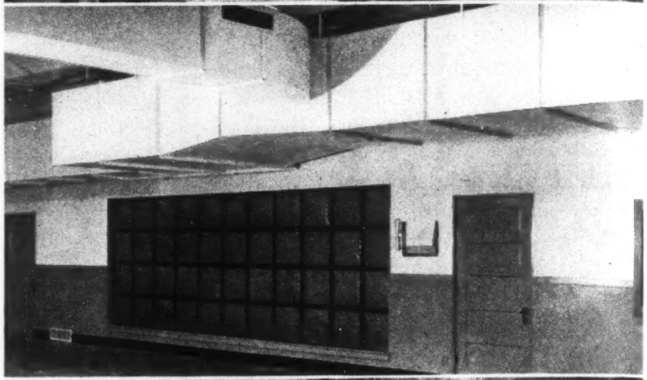
A room humidistat controls the temperature of the lithium chloride which flows over the cell contactor. When humidification is required, steam is supplied to a shell and tube interchanger which heats the solution. When dehumidification is required, water is supplied to a shell and tube interchanger which cools the solution.

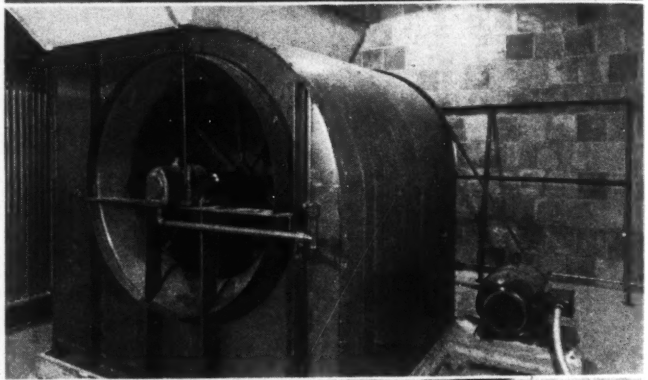
The density or concentration of the lithium chloride is kept practically constant by means of a density control which is essentially a hydrometer. When the concentration lowers (due to dehumidification), the density control opens a steam valve to a heater which heats the solution going to the regenerator. When the concentration is high (due to humidification), the density control opens a valve which allows steam condensate to run into the sump.

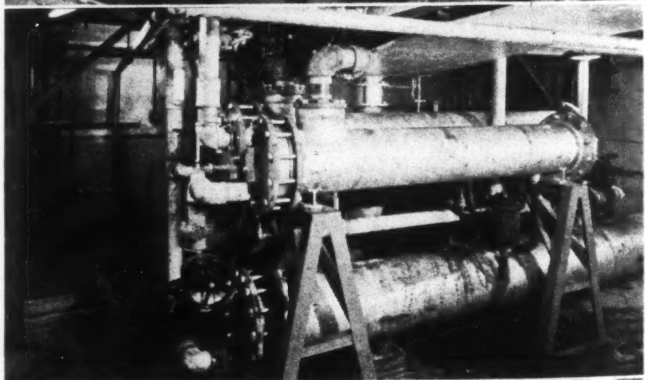
A room thermostat controls the water to the cooling coils and steam to the heating coils.

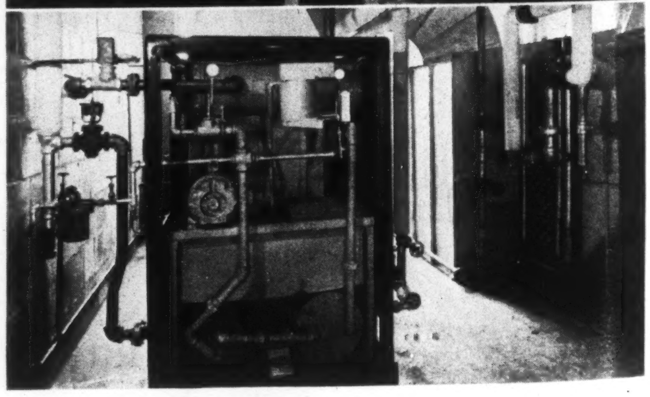
Temperature and humidity must also be controlled in the cylinder room, where the copper cylinders with which the printing of the Cellophane is accomplished are etched, for the carbon tissue used in this process is very susceptible to changes in atmospheric conditions. A package type humidity control unit handling 2500 cfm of outside air and 10,000 cfm of return air supplies this department, which is in an older section of the plant, and maintains the same conditions there as in the press room. The outside air is precooled by a coil through which is circulated well water, the same water then goes to the solution cooler, and is finally sprayed on the roof of the











TOP TO BOTTOM

Windowless press room (before installation of presses) which is maintained at 80 F dry bulb and 45 per cent relative humidity 24 hours a day the year around. By using windowless construction and air conditioning, cost of this plant addition was less than $5000 more than a structure of more conventional construction but without air conditioning

Return air inlet from the press room to the air conditioning equipment, showing the filters. The cooling coils through which well water is circulated are immediately behind these filters. The supply ducts leaving the conditioning equipment are at the top of this view

The fan which supplies conditioned air to the press room. A glimpse of the coils which are immediately behind the filters shown in the preceding picture is seen at the left of this view

These heat interchangers are the solution heaters and coolers for the press room conditioning system, supplied with 3 lb plant steam and cold well water respectively

The package type lithium chloride unit for the cylinder room; the press room equipment illustrated in the other pictures is of the cell type, being of larger size. The casing—one end of which is removed here—contains the contactor, solution heater and cooler, sump, solution circulating pump, density control, etc.

plant to reduce the heat gain. In winter, this package unit humidifies the cylinder room air when necessary as does the larger cell type unit which serves the press room.

Shellmar considers that close control of temperature and humidity in the plant is essential, for atmospheric conditions affect the material being printed, the inks used, and the preliminary steps of the process such as etching the cylinders. As one executive of the plant expressed it, air conditioning "puts a floor under research." Studies of the process and new methods are constantly being made, and with the work done under constant atmospheric conditions there is a "base" on which to build and from which to make comparisons of different methods. Were temperatures and humidities to vary from one day to the next—or one hour to the next—there would be no way of telling whether a difference between two methods was due to that difference, or due to changed temperature and humidity conditions. In many industries, the air of a plant in which a process or manufacturing method is being carried on is as much an ingredient or material of the process as anything else; consequently, the condition of that air must be under control just as must the other ingredients or materials.

Tubing of Impervious Carbon and Graphite

The inertness of carbon and graphite to the action of chemicals, excepting those of a strongly oxidizing nature, has been known since the Middle Ages, but exploitation of this property in the process industries has been hitherto restricted because of the porosity of the fundamental forms in which the material was fabricated. This porosity is so great that carbon plates are used for some filtration operations. Now, however, fabricated tubing of non-porous, synthetic resin-impregnated carbon or graphite, through which many corrosive liquids may be safely transferred, has been developed, in sizes suitable for chemical engineering construction. The resin impregnation treatment does not affect adversely its resistance to electrical corrosion. The new material, moreover, possesses the additional advantage of greater mechanical strength without concomitant increase in electrical resistance. Tubing of impervious carbon or graphite is reported as capable of withstanding pressures ordinarily encountered in the process industries; it is further characterized by a very low coefficient of expansion, lightness in weight, and high resistance to thermal shock. Unlike ordinary carbon and graphite, the impervious carbon materials are not recommended for temperatures above 175 C.

In all of these properties tubings produced from impervious carbon and graphite are virtually alike, with the single exception of heat conductivity, in which respect the graphite is distinctly superior. Comparative tests on new, clean tubings against other metals indicate that the rate of heat transfer of the graphite tubing, which lies beween that of copper and that of steel, is better than that of many of the metals and alloys frequently employed in corrosion resistant equipment. Since no formation of heat resisting corrosion scale is anticipated on the graphite, it is assumed that over a period the rate of heat transfer through the graphite will approach even closer to that of copper.

The new materials are available in standard sizes in lengths up to 6 ft, and 6 in. inside diameter, plain, threaded or flanged, together with a line of fittings. It is reported that complete tube bundles of impervious graphite are now being supplied to manufacturers of heat exchangers. The development is new, and its progress will be watched with interest by the process industries.—*Industrial Bulletin* of Arthur D. Little, Inc.

Check Charts for Air Conditioning Calculations

By J. M. Dean*

ON THE next page are published Charts Nos. 13 and 14 of a series, the first of which appeared in the May, 1938, H. P. & A. C. with a general introduction. These charts were developed in connection with the author's duties as air conditioning engineer for an electric utility in an endeavor to reduce the work of checking air conditioning calculations to a simple routine procedure.

Chart 13 enables determination of the saturation temperature of the air leaving coils. It requires three operations and is self-correcting in its operation inasmuch as the final result may be read on either scale and must be made to read the same on both scales.

Chart 14 makes use of the same required data as Chart 13 in order to determine proportions by weight of air through coils and bypass.

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*Air Conditioning Engineer, Des Moines Electric Light Co. All rights reserved.

New Edition of Refrigerating Data Book

The fourth edition of the "Refrigerating Data Book," published by the American Society of Refrigerating Engineers, 37 W. 39th St., New York, N. Y., will appear in January, the A.S.R.E. announces. The book will carry the format and arrangement of its predecessors, but will be improved in content, and will include specification tables and other information on available equipment. A. B. Stickney, engineer, Armour and Co., is chairman of the book committee.

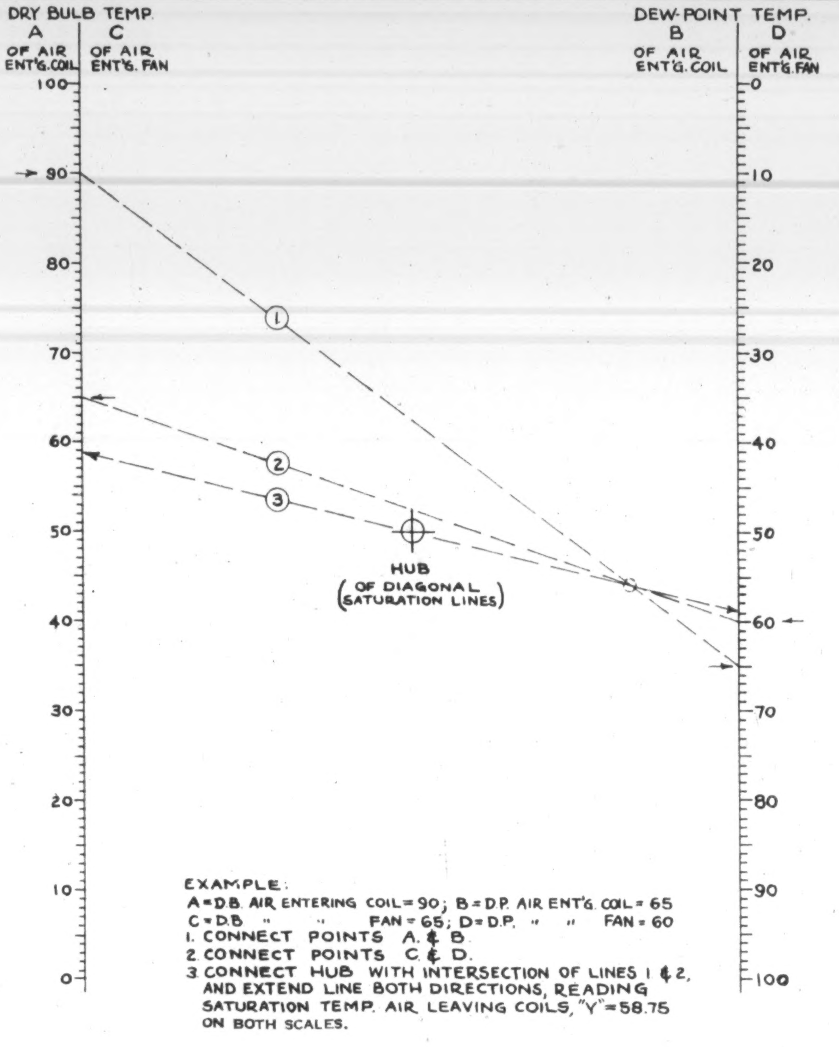
The new edition will not contain a section on applications, such as composed the last part of the one published two years ago. Instead, the parts dealing with basic data and equipment for producing refrigeration have been expanded. It is planned to cover, the applications of refrigeration in a second volume to appear two years hence.

The fourth edition will have 50 chapters, divided into eight parts, which can be referred to readily by thumb tabs, an innovation. The parts are refrigeration (principles); refrigerants; heat flow and insulation; air conditioning; foods; domestic—commercial machinery; industrial machinery; and controls and power. Price is $4.00 in the U. S. A.

Check Charts for Air Conditioning Calculations

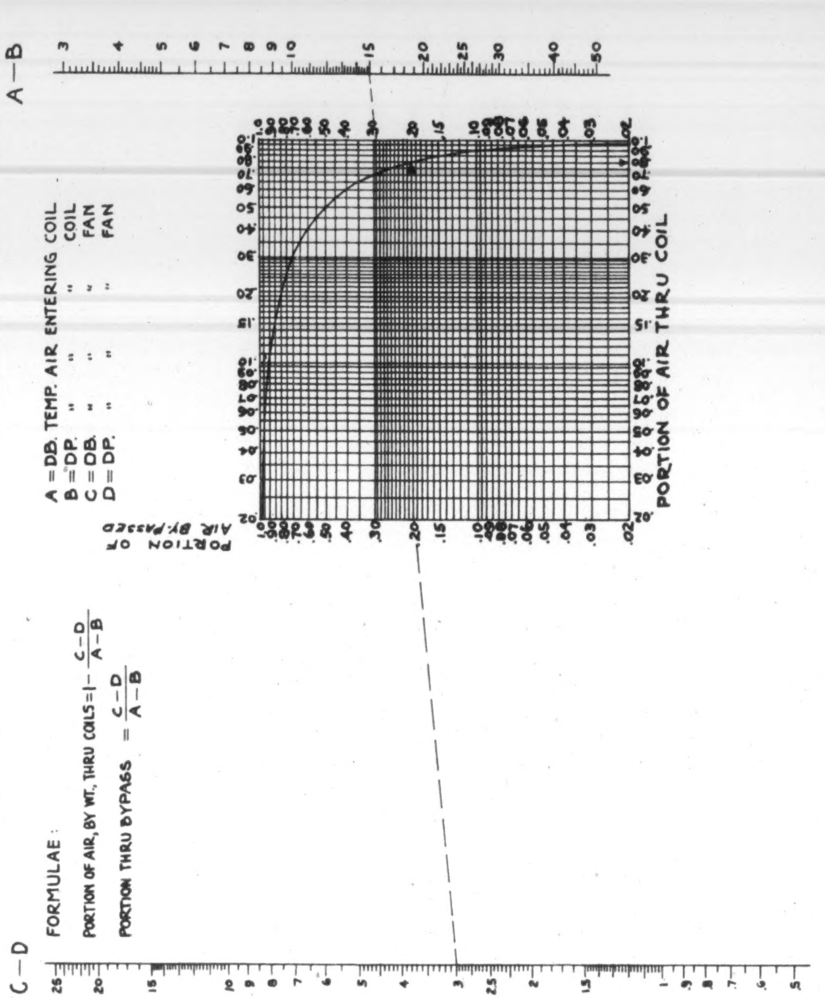
[See preceding page]

Chart No. 13



EXAMPLE:
A = D.B. AIR ENTERING COIL = 90; B = D.P. AIR ENT'G. COIL = 65
C = D.B. " " FAN = 65; D = D.P. " " FAN = 60
1. CONNECT POINTS A & B.
2. CONNECT POINTS C & D.
3. CONNECT HUB WITH INTERSECTION OF LINES 1 & 2, AND EXTEND LINE BOTH DIRECTIONS, READING SATURATION TEMP. AIR LEAVING COILS, "Y" = 58.75 ON BOTH SCALES.

Chart No. 14



FORMULAE:

PORTION OF AIR, BY WT. THRU COILS $= 1 - \frac{C-D}{A-B}$

PORTION THRU BYPASS $= \frac{C-D}{A-B}$

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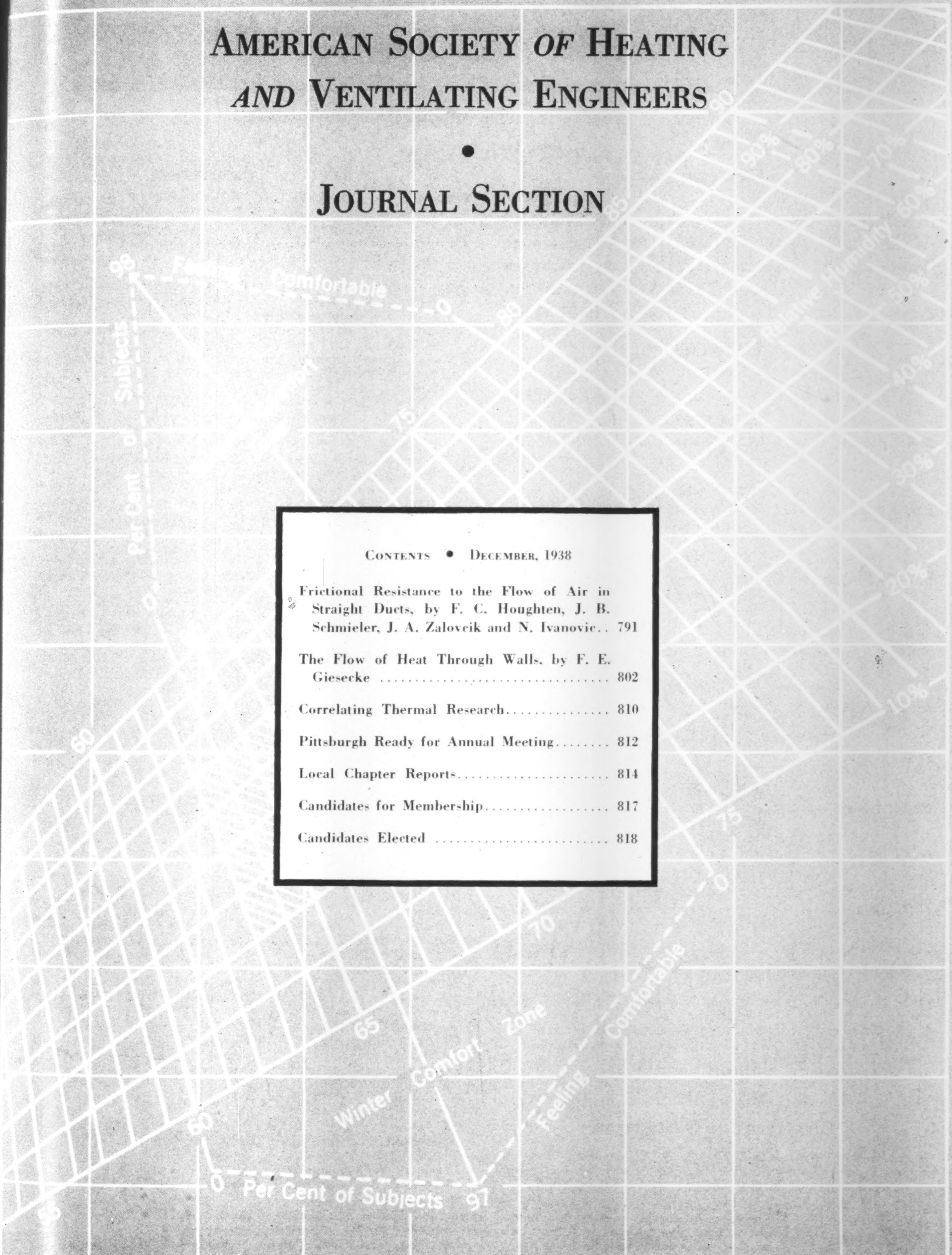

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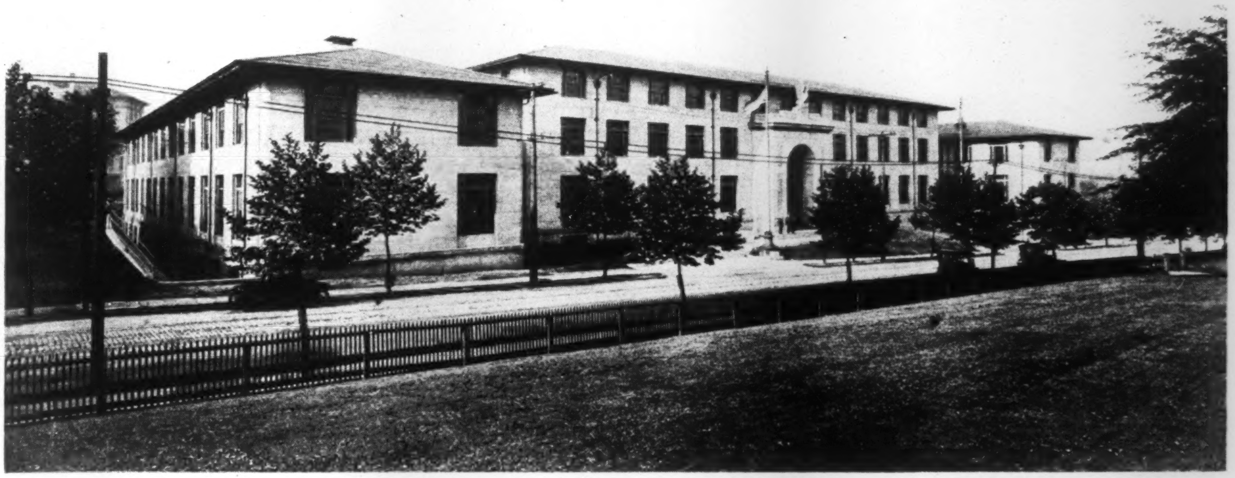
WISCONSIN: *Organized,* 1922. *Headquarters,* Milwaukee, Wis. *Meets,* Third Monday in Month. *President,* D. W. Nelson, University of Wisconsin, Madison, Wis. *Secretary,* T. M. Hughey, 906 N. Fourth St.



Pittsburgh Experiment Station of the U. S. Bureau of Mines where the Research Laboratory of the American Society of Heating and Ventilating Engineers is located

Frictional Resistance to the Flow of Air in Straight Ducts

By F. C. Houghten[*], J. B. Schmieler[**], (*MEMBERS*),
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THE increase in the use of air distributing systems in connection with heating, cooling and air conditioning during the past decade has resulted in a more critical interest in the design and cost of duct work. In this connection, there developed a lack of confidence in the available design data for estimating the carrying capacity of a given size of duct for a given pressure loss. In order to correct this condition, the Research Laboratory was asked to make a study of the frictional resistance to the flow of air in ducts and fittings. The work was undertaken at the Laboratory under the Technical Advisory Committee on Air Distribution and Air Friction, whose personnel during 1938 included: J. H. Van Alsburg, *Chairman*, S. H. Downs, M. K. Fahnestock, F. J. Kurth, R. D. Madison, L. G. Miller, D. W. Nelson, C. H. Randolph, Ernest Szekely and G. L. Tuve.

The program originally laid out by the Committee included a study of the frictional resistance to the flow of air in straight runs, elbows, Y's, reducers, and other fittings commonly included in air distributing systems. The study of elbows was to include variations in radius of curvature, with and without turning blades. The first set-up was designed to include two elbows with variations in the set-up to include Y's and other connections. Early in the investigation difficulty was experienced in accounting for some of the results obtained both for the straight ducts and more particularly for the elbows, and in order to simplify the procedure attention was limited to the study of the flow of air in straight ducts. The study of straight ducts was outlined to include round ducts, square ducts, and ducts of rectangular cross-section of various aspect ratios. Different essentials in design and workmanship including ducts laid out and built in local shops and ducts fabricated under mass production methods in a factory for wide distribution were to be studied. Here again, the difficulties involving variations in joints due to design and workmanship resulted in a further curtailment of the original program to include only round and square ducts of two designs, referred to as *shop-made* and *factory-made* with the exception of a single rectangular duct, $15\frac{5}{16}$ by $3\frac{3}{4}$ in. in cross-section. The future program of the Committee provides for a continued investigation of those phases of the study not completed to date including rectangular ducts, and fittings.

This paper includes the results of the study on the frictional resistance to the flow of air in 4-in., 8-in. and

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24-in. round ducts and square ducts of approximately equivalent carrying capacity for the same frictional resistance. Results of the frictional resistance to the flow of air in straight ducts without joints and the added resistance offered by joints are included. The paper also presents the relationship between the friction factor and the Reynolds Number found for the round ducts. A modified form of the Fanning equation is shown to apply with a high degree of accuracy for the three sizes of ducts, justifying its use for expanding friction flow characteristics from the three sizes of ducts studied to smaller, intermediate and larger sizes, which can be used with confidence for ducts up to at least 4 ft in diameter, and probably without any considerable error for a wider range. Friction charts based on this expansion are presented for round duct without joints and for round duct with 40 joints per 100 ft of run, ranging from 3 in. to 100 in. in diameter. Based upon the relation between the friction found for round and for square duct and assuming spacing of joints as found in common practice, a modified form of the conversion equation was developed for determining the diameter of a round duct having the same carrying capacity with the same frictional resistance as a given rectangular duct, and a conversion table based upon this formula is presented.

Test Set-up and Procedure

Fig. 1 is a photograph of the 7.2-in. square factory-made duct and Fig. 2 a drawing of the test set-up as used for the 8-in. round, shop-made duct. Excepting for transformation pieces to accommodate the different sizes of duct and a larger fan used in the case of the 24-in. round and 22-in. square ducts, essentially the same arrangement was used in studying the other sizes. Elbow losses were studied in connection with the 4- and 8-in. ducts. Since this phase of the study was postponed, elbows were not included in the set-up for the 24-in. round and equivalent square ducts. The desired air velocity through the test section was supplied by a blower equipped with a throttling damper on the intake side. Just beyond the outlet of the blower a relief damper, consisting of 26 1-in. holes around the duct and equipped with a collar, gave further control of the rate of air delivery. For ease in measuring the desired rate of air flow, a U. S. Bureau of Standards calibrated nozzle was located between two 10-ft sections of 12-in. duct. A test section of 8-in. duct was connected to the 12-in. measuring section through a 2-ft, 5-deg transformation piece, a 4-ft section of 8-in. duct containing a straightener, and a 10-ft section containing a Pitot tube. A straightener also preceded the measuring section of 12-in. duct.

For all sizes of duct studied approximately 60 ft of straight run was used. Provision was made for observing the wet- and dry-bulb temperature of the air after it passed through the nozzle. A Pitot tube station was located in the 60-ft straight run of 8-in. duct 7½ diameters beyond the straightener. A number of static stations for measuring pressure were located throughout the length of the test section. While the nozzle referred to previously was always used to observe the rate of air flow, the velocity was also checked by a standard Pitot tube whose design is specified in the 1938 edition of the Standard Test Code for Centrifugal and Axial Fans, adopted by a Joint Fan Test Code Committee of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS and the *National Association of Fan Manufacturers*. Three other Pitot tubes were used. It is of interest to note that, with the precautions taken to insure uniform flow, of the four Pitot tubes used one read about 0.6 per cent lower, another about 0.8 per cent lower, and a Prandtl tube gave identical results as the standard tube. The standard Pitot tube gave air quantities 1.1 per cent larger than the calibrated nozzle.

Static stations were placed at frequent intervals along the test section of the duct. The type of static pressure opening is shown in detail in Fig. 2C, and the arrangement whereby four static pressure openings were connected into one tube is shown in Fig. 2B. The type of air straightener used was of the *egg-crate* design and is shown in Fig. 2A. This arrangement was adopted after some experimentation and a great deal of consultation with other experimenters interested in this type of work.

The static pressure differences between stations along the duct, for the Pitot tubes, and for the nozzle, were obtained by the use of either an inclined manometer gage or a Wahlen gage, the latter being used when the pressure differences were small. Xylene with analine

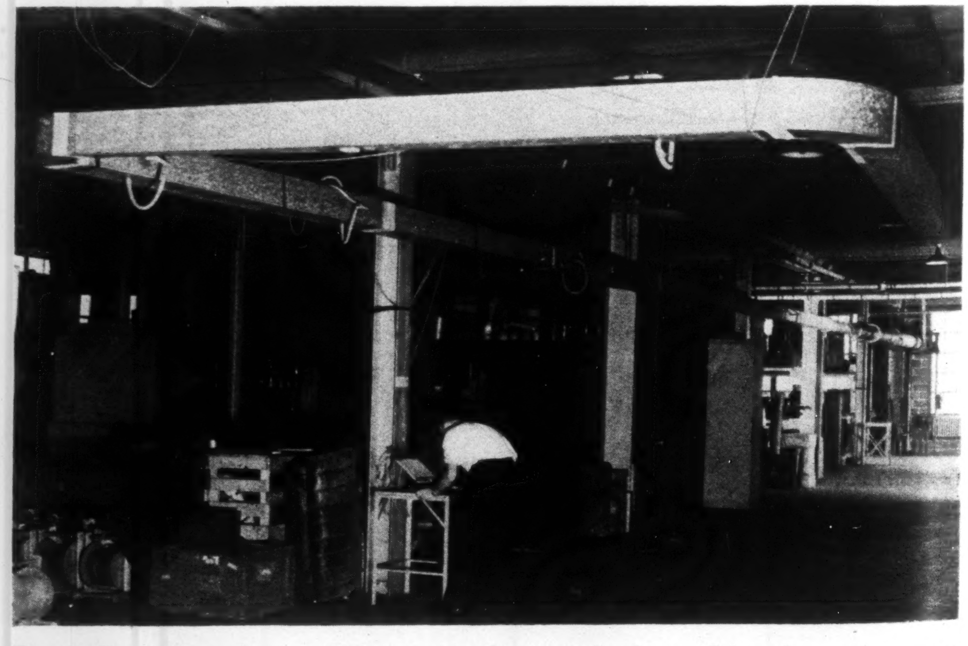

Fig. 1—Test set-up showing 7.2-in. square, factory-made duct. Other duct set-ups were essentially the same

dye added was used in the inclined gage because its density does not vary appreciably with temperature and evaporation. The Wahlen gage[1] used is accurate to 1/1000 of an inch of water pressure.

The formula used to give the air delivery by the nozzle was:

$$V = 4005\, C_d\, C_n \sqrt{h/S} \qquad (1)$$

where,

V = actual nozzle velocity in feet per minute
h = pressure drop across the nozzle in inches of water
C_d = coefficient of discharge = 0.98
C_n = nozzle coefficient = $\dfrac{1}{\sqrt{1-(d_2/d_1)^4}}$

where,

d_2 = throat diameter of nozzle
d_1 = line diameter of nozzle
S = ratio of test air density to standard air density (dry air at 70 F and 29.92 in. Hg) = $\dfrac{17.72 \times BP - 6.70 \times E}{460 + T_t}$

where,

BP = barometric pressure in inches of Hg
E = vapor pressure at the dew-point of the mixture
T_t = test temperature in degrees Fahrenheit

To obtain the velocity in the duct the following relation was used:

$$V_d = \frac{V_n A_n}{A_d} \qquad (2)$$

where,

V_d = duct velocity
V_n = nozzle velocity
A_n = nozzle throat area
A_d = duct area.

The Pitot tube readings were converted into velocities by using the formula:

$$V = 4005\sqrt{h/S} \qquad (3)$$

where,

h = velocity head in inches of water
S = (same as in formula (1) for air delivery by the nozzle).

In making a traverse the positions at which observations were made were such as to give an average velocity when the arithmetical average of the several velocities was taken. The positions were determined by dividing the duct area into several equal concentric areas. The position taken in each concentric area was such that a circle drawn through it would divide this area into two equal concentric areas. For any circle thus drawn there would be two observation points along any diameter, one on either side of the center of the duct. It can be seen that the arithmetical average of the velocities at these points approximates the average velocity in the duct. This approximation improves as the number of points is increased. A mathematical equation can be used giving the distance along the radius where readings are to be taken for a duct divided into any number of equal concentric areas. This equation is:

$$r = \frac{D}{2}\sqrt{\frac{2X-1}{2N}} \qquad (4)$$

where,

r = distance along a radius from the center of the duct to the point at which the reading is to be taken
D = diameter of duct
X = number of the concentric area where the central area is 1
N = number of equal concentric areas into which the duct area is to be divided.

Average duct velocities were also obtained by plotting the velocities at these points, integrating the area with a planimeter and calculating average velocities. This method was found to give slightly better results and was used for actual calculations.

Before making a test on any given duct the intake and relief dampers were arranged to give the desired rate of flow, after which the system was continued in operation long enough to establish equilibrium of temperature and flow before making observations. The temperature (dry-bulb and wet-bulb) of the air, rate of air flow, barometric pressure and pressure drops along the duct were then taken by one observer while an assistant watched the nozzle differential gage in order to insure

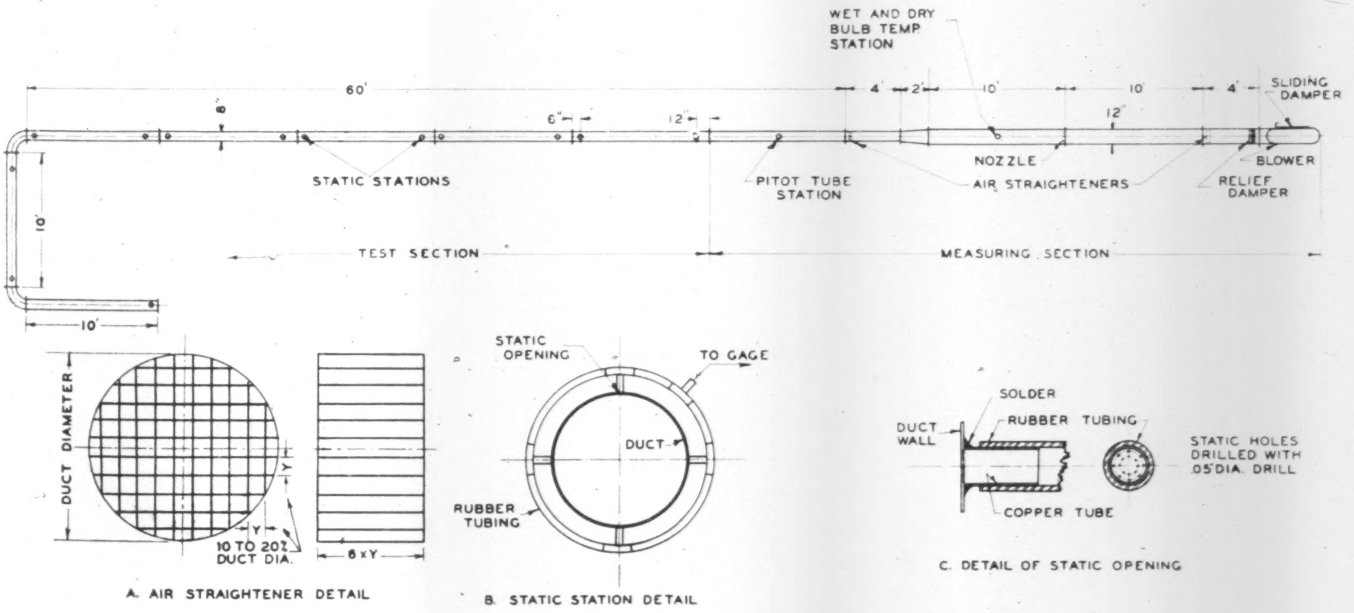
WET AND DRY BULB TEMP STATION
60'
8"
6"
12"
4'
2'
10'
10
12"
4'
SLIDING DAMPER
STATIC STATIONS
PITOT TUBE STATION
NOZZLE
AIR STRAIGHTENERS
BLOWER
RELIEF DAMPER
10'
TEST SECTION
MEASURING SECTION
10'
DUCT DIAMETER
Y
Y
10 TO 20% DUCT DIA.
6 x Y
A. AIR STRAIGHTENER DETAIL
STATIC OPENING
TO GAGE
DUCT
RUBBER TUBING
B. STATIC STATION DETAIL
SOLDER
DUCT WALL
RUBBER TUBING
COPPER TUBE
STATIC HOLES DRILLED WITH .05"DIA. DRILL
C. DETAIL OF STATIC OPENING

Fig. 2—Test set-up showing 8-in. round duct. Other duct set-ups were essentially the same

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[1] See Bibliography (1).

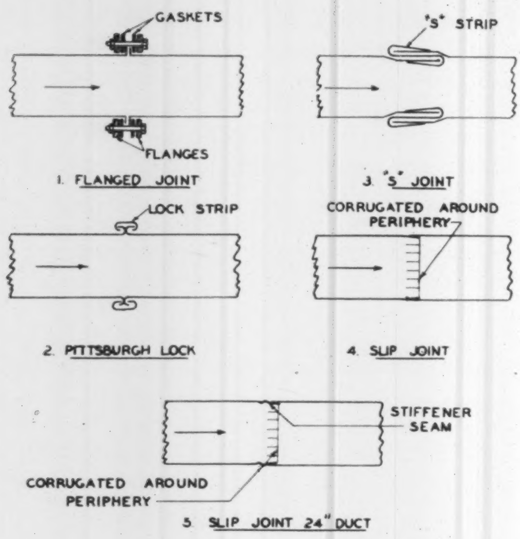

Fig. 3—Detail of the different joints used

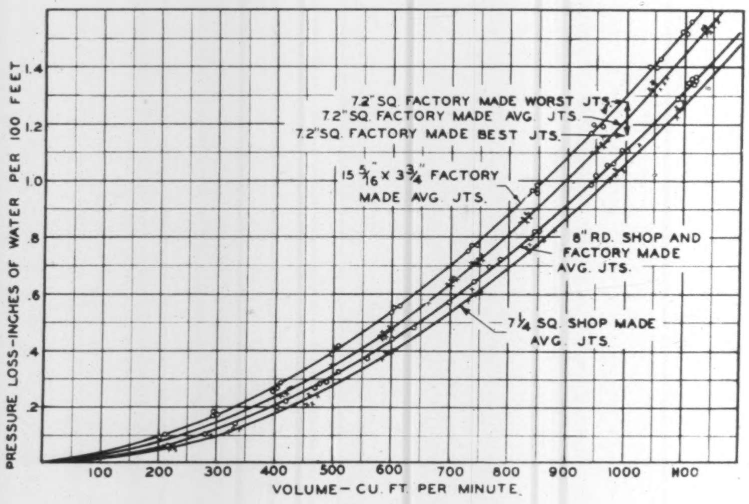

Fig. 4—Relation between pressure loss and volume for 8-in. round and equivalent square and rectangular ducts with actual test points. The variation in the effect caused by the best and worst joints found for the factory-made 7.2-in. square duct is indicated by arrows. The 7¼-in. square shop-made duct had 12 joints per 100-ft length of run. All others 10 joints

Table 1—Characteristics of Ducts Studied

SHAPE OF DUCT	SIZE	MAKE	TYPE JOINT (A)	ACTUAL NO. OF JTS. PER 100 FT.
ROUND	4"	SHOP MADE	4	10
ROUND	4"	FACTORY	4	10
SQUARE	3⅝"	SHOP MADE	2 & 3 (B)	12
ROUND	8"	SHOP MADE	1	10
ROUND	8"	FACTORY	4	10
SQUARE	7¼"	SHOP MADE	2 & 3 (B)	12
SQUARE	7.2"	FACTORY	3	10
RECTANGULAR	15 5/16" x 3¾"	FACTORY	3	10
ROUND	24"	SHOP MADE	5	40
SQUARE	22"	SHOP MADE	2	25

A. See Fig. 3.

B. Each joint consisted of No. 2 on two opposite sides and No. 3 on the other two sides.

uniform rate of air flow during the observations. In most tests, several pressure drops between as many different pairs of static stations were observed in order to give pressure drop flow relationship through different parts of the duct, particularly as it was affected by variations in joints. The pairs of static pressure stations were chosen so as to include the pressure drop through the maximum length of straight duct including all joints, the maximum length of straight duct not including any joint, and the drop across a single joint. A series of tests was always made on a given test set-up at velocities ranging from the minimum giving a satisfactory pressure difference for the given size of duct, up to the maximum possible with the fan and duct arrangement, which was usually about 3500 fpm. Check tests were always made on a given set-up on at least two different days. If these results did not check, the system was carefully examined for defects, usually leaks, and tests were repeated until satisfactory results were obtained. Joint leaks were prevented by first sealing with plasticine and then wrapping with adhesive tape which was painted aluminum.

Test Results

Results of a great many tests on different set-ups, including shop-made and factory-made round duct 8 in. in diameter, shop and factory-made square duct of approximately the same carrying capacity, and a factory-made rectangular duct of approximately the same carrying capacity are given in Fig. 4. Curves with test points are given for 7¼-in. square shop-made duct with average joints, 7.2-in. square factory-made duct with average joints, 8-in. round shop and factory-made duct with average joints, and $15\frac{5}{16}$ by 3¾-in. factory-made with average joints. The 8-in. round, and equivalent square and rectangular ducts were the first studied, and a great many tests were made while the effect of joints was being investigated. As a result, these ducts were erected and dismantled a number of times, which accounts for some of the dispersion of test points from the curves as drawn. Nevertheless, the points indicate a very definite curve in each instance. It will be noted that the several ducts as originally chosen did not have the same carrying capacity. The higher resistance shown by the factory-made, square and rectangular ducts was probably due to the relatively crude joints between sections, offering in some cases noticeable constrictions.

Reference to Table 1, which gives the characteristics of the different ducts studied, shows that the same joint distribution was not obtained for all the different ducts. Also, there will be apparent to individuals accustomed to duct design the fact that the length of duct between joints as tested does not in all cases represent common practice. This discrepancy, however, is corrected in later charts, where the resulting calculated relationship between friction and flow, places all of the data on a more comparable basis. As pointed out previously, there was considerable difference in the uniformity in appearance of constrictions resulting from the joints in the different ducts. The 7.2-in. square factory-made and equivalent rectangular ducts showed the most variation in individual joints. The result of this variation on the resistance to flow through the joints of the 7.2-in. square factory-made duct is indicated by arrows on the curve for the duct in Fig. 4.

Curves similar to those in Fig. 4 were plotted for each of the three sizes of duct studied. However, since the length of section between joints did not represent usual practice in all cases, these are not presented, but, instead, there are included Figs. 5, 6 and 7, which give the calculated friction flow relationship for the number of joints per 100-ft length of run indicated in each case for the three sizes of duct tested. For this calculation the frictional resistance to the flow through a duct with no joints was determined by the pressure loss through a test section with no joint between static stations. The frictional resistance through the average joint is given by the formula:

$$J = \frac{h_w - C_0 \times L}{N} \qquad \text{.........................(5)}$$

where,

J = frictional resistance through the average joint in the test section
h_w = frictional resistance through the entire test section including straight run of duct and joints
C_0 = frictional resistance per foot of duct without joints as defined previously
N = number of joints between static stations
L = total length of test section.

The frictional resistance for 100-ft length of the same duct with any other number of joints, N', then becomes $H_F = 100\ C_0 + JN'$. The number of joints indicated for each size and type of duct is assumed to represent usual practice in each case. The curves mentioned show clearly the variations existing, when results based on common practice using present conversion formulae are plotted. Better results would be obtained if equivalent square and rectangular duct sizes had been calculated using the conversion formula as given later in the paper.

In order to present a better picture of the relation between friction and velocity of flow for the three sizes of round duct, these relationships are all plotted to the same scale in Fig. 8. The relation between the friction through the average joint for each duct and the velocity of flow is given in Fig. 9. The length of straight duct offering frictional resistance equal to that of a single joint in the duct should undoubtedly bear some definite relation to the velocity through the duct. Stated mathematically this equivalent length is defined as:

$$E = \frac{J}{H_f} \qquad \text{...(6)}$$

where,

E = equivalent length of joint in feet of duct
J = average joint loss
H_f = static pressure loss per foot of duct without joints.

Sufficient data are not available to establish this relationship for all velocities. It is, however, given for a velocity of 2000 fpm in each duct. It will be noted that

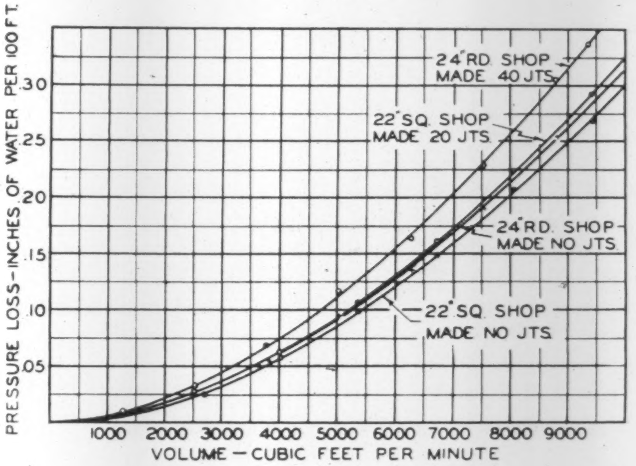

Fig. 5—Relation between pressure loss and volume for 24-in. round and equivalent square duct calculated from test data for 100-ft length of run with no joints and with the indicated number of joints

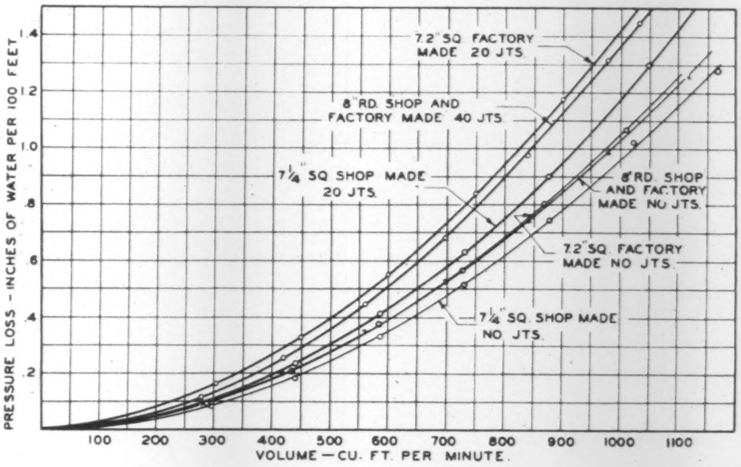

Fig. 6—Relation between pressure loss and volume for 8-in. round and equivalent square duct calculated from test data for 100-ft length of run with no joints and with the indicated number of joints

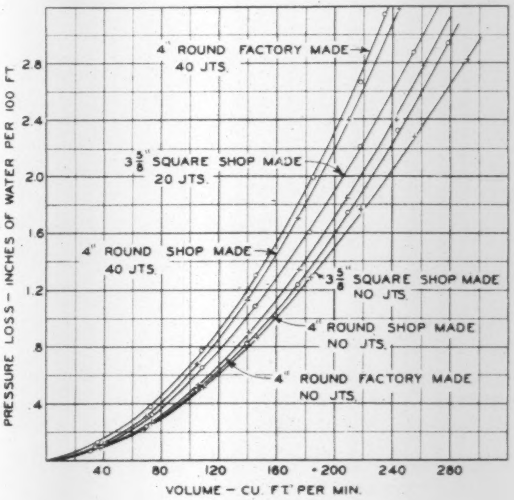

Fig. 7—Relation between pressure loss and volume for 4-in. round and equivalent square duct calculated from test data for 100-ft length of run with no joints and with indicated number of joints

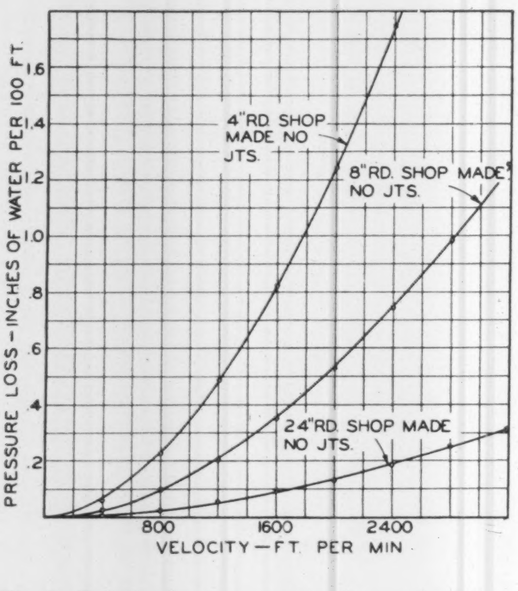

Fig. 8—Relation between pressure loss and velocity for 24-in., 8-in. and 4-in. round duct with no joints

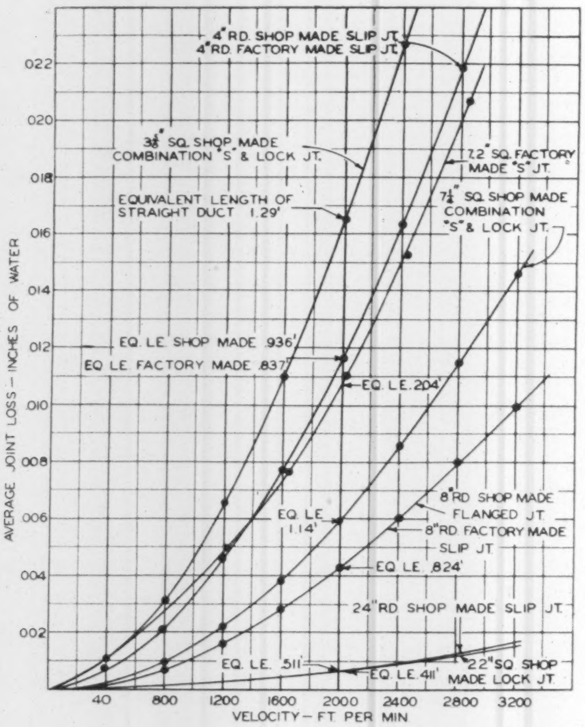

Fig. 9—Relation between average joint loss and velocity for all ducts tested

the 7.2-in. square factory-made joint gives a high friction compared to the other ducts of this equivalent size. The average joints in the different sizes offered resistance to flow at 2000 fpm equal to from a little under ½ ft of straight duct to a little over 2 ft. The high friction offered by the average joint in the 7.2-in. square factory-made duct accounts in part, at least, for the high resistance for this duct with average joints. This was in part due to the many tests made on this duct requiring the duct to be taken apart and reassembled a number of times.

Reynolds Number Relationship

The relation between the Reynolds Number and the pressure producing flow of any fluid, either liquid or gas, has been a great aid in developing a comprehensive understanding of the flow of such fluids. These relationships have their bearing not only on an understanding of the flow of fluids in pipe, but also on the flow of fluids under any other conditions, including convection currents set up near any heating or cooling surface and the effect of these convection currents on heat transfer. When applied to the flow of fluids in pipe, the Reynolds Number, defined as a dimensionless number, is expressed as:

$$R = \frac{DV\rho}{\mu}$$

where,

R = the Reynolds Number
D = diameter of the pipe in feet
V = velocity in feet per second
ρ = density of the fluid in pounds per cubic foot
μ = absolute viscosity of the fluid in pounds per foot second

Reynolds was able to show that for any pipe and any fluid, either liquid or gas, the flow was streamline when this dimensionless number had a small numerical value, usually below 2000 or 3000, while the flow generally became turbulent when the Reynolds Number exceeded this value. Streamline flow may exist for a Reynolds Number as high as 50,000 if care is taken to minimize the effects of initial disturbances. However, this represents an unstable condition and is seldom encountered in common practice and, for all practical purposes, turbulent flow generally exists for a Reynolds Number above 2000 to 3000. Air flowing under all practical conditions gives Reynolds Numbers above this critical value, indicating that the flow is always turbulent. To illustrate, standard air flowing in an 8-in. duct gives a Reynolds Number of 2500 when the velocity is 37 fpm.

It has been amply shown that, provided all the dimensionless characteristics of a pipe of a given material are similar and proportional, regardless of its diameter a single curve will express the relation between the friction factor and the Reynolds Number. The friction factor for this purpose is expressed by some authors as the reciprocal of the number of diameters length of the pipe necessary to cause a loss of one velocity head, while other investigators are accustomed to use friction factor values one-quarter smaller. The former is used in this paper but the resultant friction loss is identical in either case, since the difference in friction factor is accounted for in the respective friction loss formulae. To the extent to which this physical law is true, a single friction factor-Reynolds Number curve determined for any fluid flowing in any pipe should amply express the relationship for any other fluid flowing in this or any other pipe of the same type and material, regardless of size. The practical application of this theory in building up friction flow relationships for the flow of different liquids and gases in different types of pipe for practical use has caused a great deal of misunderstanding. One simple requirement for the application of the theory is usually forgotten, namely, the provision that all dimensionless characteristics of the different sizes of pipe of the same material must be proportional; that is, as the diameter of the pipe changes, the roughness of the interior surface, the irregularities caused by joints, and presumably the length of sections between joints must all change in proportion to the diameter. In practice this requirement obviously never exists, and particularly is this true in the case of galvanized ducts of different sizes. The roughness of the interior of such a duct and the constriction and expansion effects at joints are practically constant regardless of the size of duct and, as a matter of fact, these irregularities may more often be greater rather than smaller in proportion to the diameter in small sizes of pipe. This is more particularly true in standard pipe. Certainly, however, in galvanized ducts the surface irregularities do not increase in proportion to the diameter; hence, a strict application of Reynolds Number should not be expected to apply.

In Fig. 10 the relation between the friction factor and the Reynolds Number, expressed in thousands, is plotted for the different sizes of round duct tested without joints and also with 40 joints per 100-ft length of run. It will be noted that for both the ducts without joints and with joints there is a consistent series of curves showing higher friction factors for the same Reynolds Number with decrease in diameter. This is as should be expected from a strict application of the Reynolds Number theory. Since the larger ducts have constrictions due to roughness, smaller in proportion to their diameter than is the case with the smaller duct, they should offer a lower friction factor index for the same Reynolds Number. It is also of interest to note the marked effect which joints in the duct have on these relationships.

For comparison, friction factor-Reynolds Number relationship curves are also included from the published results by Kemler[2] and by Bachmeteff.[3] The lack of agreement between the results of this study and the work of these investigators was the cause of a great deal of concern and extensive investigation during the early part of this study, until the importance of the proper proportion between diameter and other dimensions including roughness was taken into consideration.

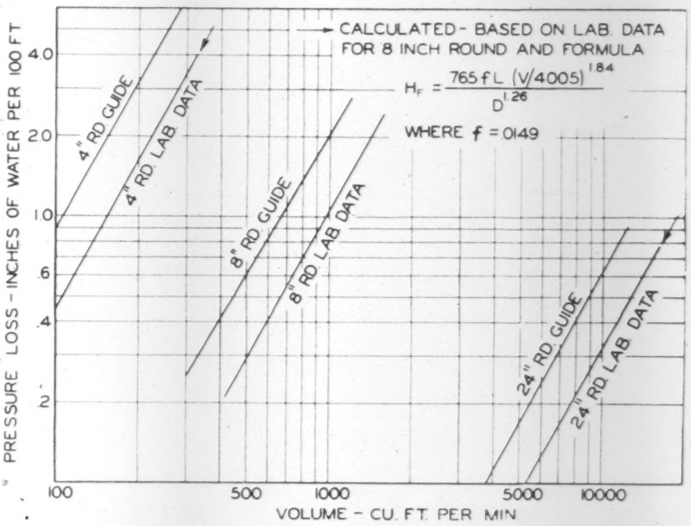

Fig. 11—Relation between pressure loss and volume for 1938 Guide data and the results of this study with no joints. Arrows indicate the location of curves for 4-in. and 24-in. round duct based on calculation using 8-in. round laboratory data and the formula given

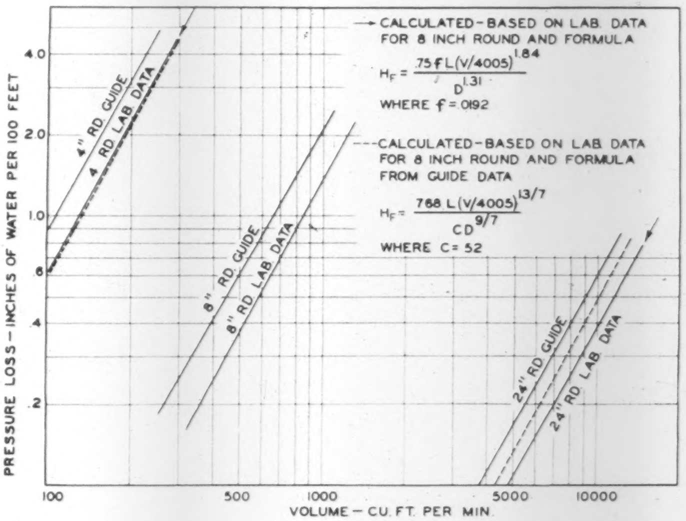

Fig. 12—Relation between pressure loss and volume for 1938 Guide data and the results of this study with 40 joints per 100-ft length of run. Arrows indicate the location of curves for 4-in. and 24-in. round duct based on calculation using 8-in. round laboratory data and the formula given. Broken line curves indicate the location of 4-in. and 24-in. round laboratory data curves resulting from formula given which applies to present Guide data

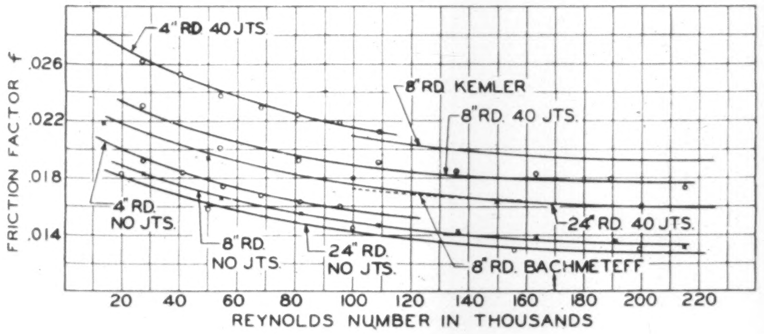

Fig. 10—Relation between the friction factor and Reynolds Number for the round ducts tested without joints and with 40 joints per 100-ft length of run. Curves for data published by Kemler[2] and Bachmeteff[3] are included

[2,3]See Bibliography (2) and (3).

The relation between the pressure loss and volume of air flowing for the three sizes of round duct without joints is plotted in Fig. 11 for the Laboratory data. Curves based upon the Friction Chart in the A.S.H.V.E. Heating, Ventilating, Air Conditioning Guide, 1938 (page 566), are also included. In order to show agreement between test data for any size of duct and the calculated relationship based upon the modified Fanning formula, the predicted position of the curves for the 4- and 24-in. ducts, based upon the Laboratory data for the 8- in. duct and the formula,

$$H_F = \frac{0.765 f L (V/4005)^{1.84}}{D^{1.26}} \quad ..(8)$$

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[2]See Bibliography (2).
[3]See Bibliography (3).

are indicated by arrows. It will be seen that a perfect check between the Laboratory data curves and the predicted location of the curves based upon calculation from the 8-in. curve results.

Similar relationships to those given in Fig. 11 are given in Fig. 12 for the three sizes of round duct with 40 average joints per 100-ft length of run. The arrows again indicate a perfect check between the curves based upon Laboratory tests on the 4- and 24-in. ducts and the calculated location based upon the 8-in. duct curve, and the formula:

$$H_F = \frac{0.75\,f\,L\,(V/4005)^{1.84}}{D^{1.31}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

It is of interest to point out that through the choice of proper exponents and constants in the formula, it would be expected that the calculated location of the arrow would agree with the curve based on test data for at least one of the 4- or the 24-in. duct. However, the fact that the calculation applies so accurately to both the smaller and the larger duct can only be accounted for by the application of a definite mathematical relationship for the different sizes of duct. This double agreement based upon calculation by a single formula should serve to lend confidence to the acceptance of the data on the three sizes of duct as a basis for expansion through this formula to smaller, intermediate and larger ducts. Certainly when this perfect agreement applies upon extrapolating from an 8-in. to a 24-in. duct, similar extrapolation up to ducts 4 or even 6 ft in diameter should be acceptable.

The broken line curves give the location of calculated curves for the 4- and 24-in. ducts based upon the Laboratory data for the 8-in. duct and the formula derived from the GUIDE data:

$$H_F = \frac{0.768\,f\,L\,(V/4005)^{13/7}}{D^{9/7}} \ldots (10)$$

It will be seen from this that, in order to extrapolate with confidence to intermediate and larger sizes of duct, it was not only necessary to establish an accurate curve for a given size of duct, but also to modify the constants and exponents in the formula by which the expansion was to be made.

Design Data

Based upon the formulae developed and used in connection with Figs. 11 and 1 the Laboratory data have been expanded into fricti charts for a wide range of sizes of round duct with joints, and with 40 joints per 100-ft length of run, Figs. 13 and 14, respectively. These charts are reco mended for practical use. As pointed out a care study of the relation between the number of joints p length of run as found in actual systems and as reco mended by different authorities indicates an avera arrangement of about one joint per every 2½ ft or 4 joints per 100-ft length of run. Based on the assum tion that this frequency of joints will fit average d sign practice best, Fig. 14 is assumed to apply. How ever, in order to give the designing engineer an unde standing of the effect of joints, as well as a bas

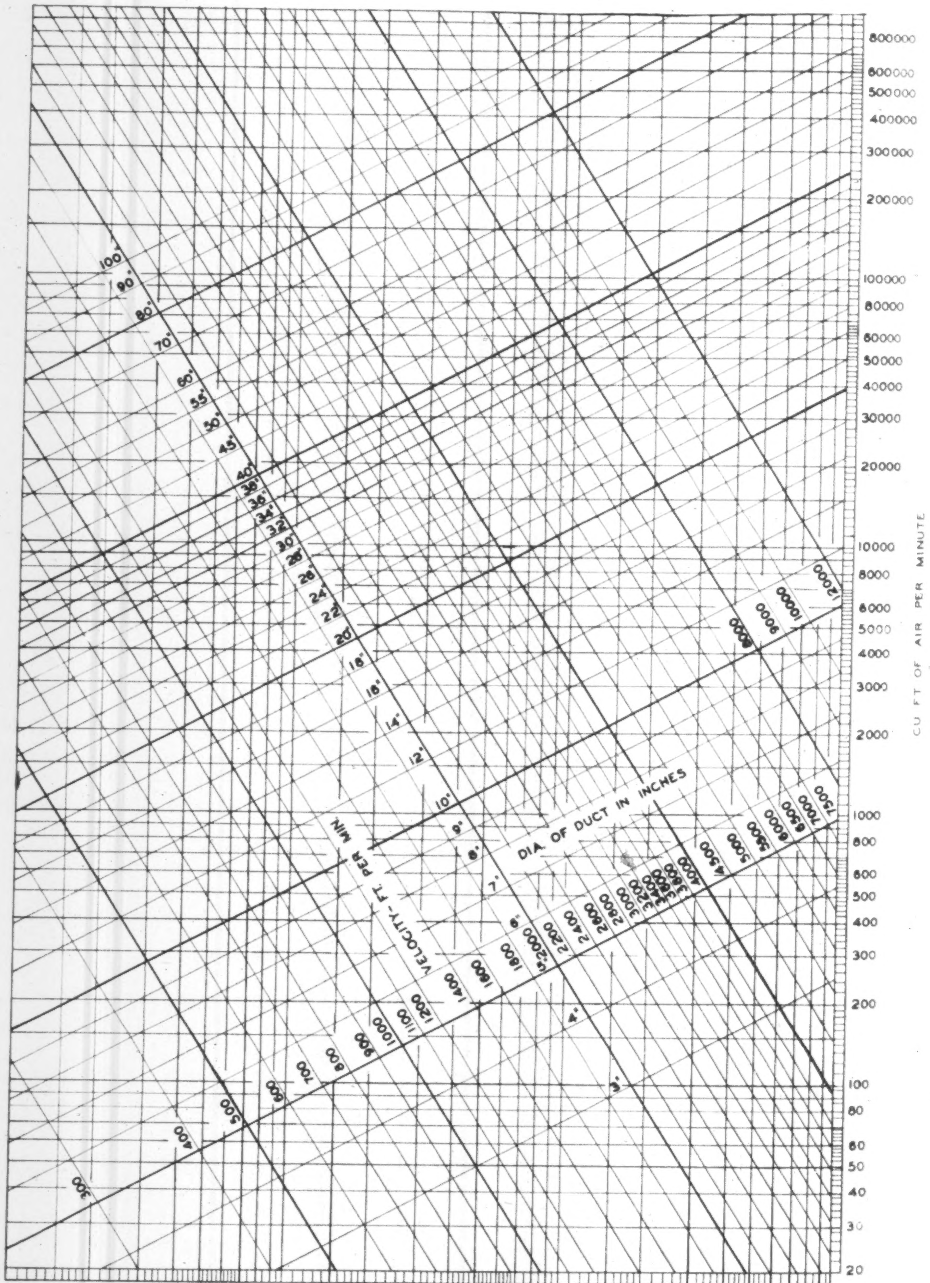

Fig. 13—Friction chart based on laboratory data for straight run of round duct without joints. No factor of safety allowed

which a design for any other duct arrangement may be corrected, the friction chart for duct with no joints, Fig. 13, is also presented.

The original plans for the duct size study included a comprehensive study of rectangular ducts of various aspect ratios, in order to establish a basis for more accurate conversion from such rectangular ducts to equivalent round. The limitation of the study to square ducts, as carried out to date, with the one exception of rectangular duct, makes the development of a conversion relationship a little uncertain. However, based upon this limited study conversion data are offered in Table 2. The data are applicable with sufficient accuracy to convert from the square to round, and may, therefore, be assumed to apply without great error for other rectangular ducts. This phase of the subject should be investigated further.

Table 2 is a conversion chart giving the equivalent round pipe (same friction loss for same volume) for various rectangular ducts. For rectangular ducts it has been found that joints occur approximately every 5 ft, and for this reason the conversion chart is based on changing rectangular duct with 20 joints per 100 ft of run to round duct with 40 joints per 100 ft. A convenient formula, using the derived friction loss formula and the hydraulic diameter relationship, $D = 4A/P$,

where,

D = diameter in inches
A = cross-sectional area in square inches
P = wetted perimeter in inches.

is as follows:

$$D = 1.306 \sqrt[4.94]{\frac{(a\,b)^{3.10}}{(a+b)^{1.26}}} \ldots\ldots (11)$$

where,

a = width of duct
b = height of duct.

Using this formula, the equivalent square duct for 4-in. round, 8-in. round and 24-in. round was calculated. This formula was found to be slightly in error when results from its application were compared with tests on the round and square ducts. The formula was therefore modified by changing the constant to give:

$$D = 1.32 \sqrt[4.94]{\frac{(a\,b)^{3.10}}{(a+b)^{1.26}}} \ldots\ldots (12)$$

which holds true for ducts with no joints or equal number of joints. To convert rectangular ducts with 20 average joints per 100 ft of run to round duct with 40 average joints, the modified formula becomes

$$D = 1.35 \sqrt[4.94]{\frac{(a\,b)^{3.10}}{(a+b)^{1.26}}} \ldots\ldots (13)$$

This formula was used in developing Table 2 which is to be used in conjunction with Fig. 13. For example, assume that the friction loss for a 16 × 14-in. duct at 2000 fpm air velocity is required. Referring to Table 2, a 16 × 14-in. duct is equivalent to a 17.1-in. round duct; referring to Fig. 13, at 2000 fpm in a 17.1-in. round duct, the loss is approximately 0.255 in. of water per 100 ft.

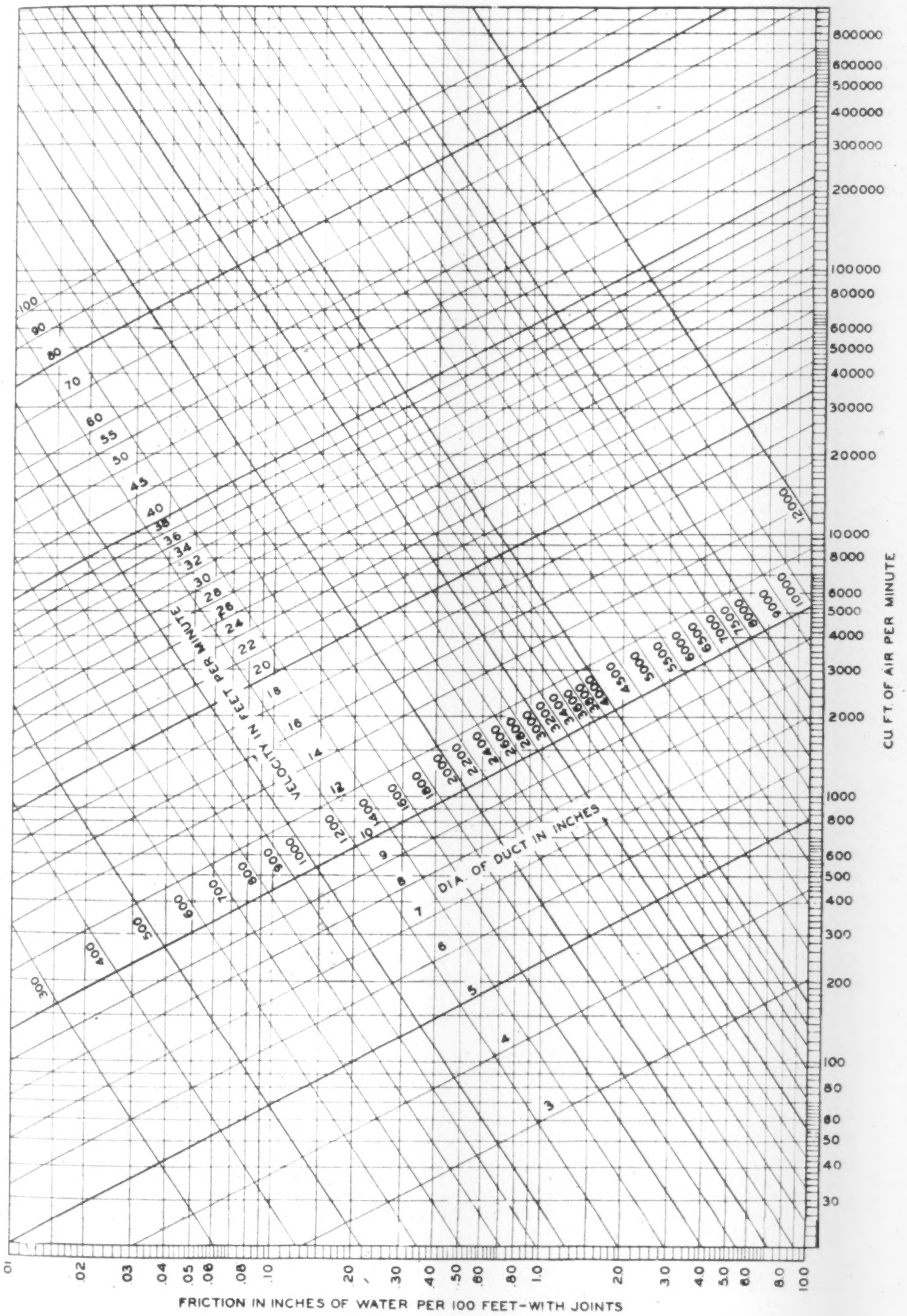

Fig. 14—Friction chart based on laboratory data for straight run of round duct with 40 joints per 100-ft length of run. No factor of safety allowed

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Table 2—Circular Equivalents of Rectangular Ducts for Equal Friction and Capacity

Side Rectangular Duct—Inches	3	3¼	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	24
6	4.7	4.9	5.5	6.1	6.7	....															
7	5.0	5.2	6.0	6.6	7.3	8.0	....														
8	5.4	5.7	6.3	7.1	7.9	8.5	9.1	....													
9	5.7	6.0	6.7	7.5	8.3	9.0	9.6	10.2	....												
10	5.8	6.2	7.0	7.9	8.7	9.5	10.1	10.8	11.4	....											
11	6.2	6.5	7.3	8.3	9.1	9.9	10.6	11.2	11.9	12.5	....										
12	6.4	6.8	7.6	8.6	9.5	10.3	11.1	11.8	12.5	13.0	13.6	....									
13	6.7	7.0	7.8	8.9	9.9	10.7	11.5	12.2	13.0	13.6	14.2	14.8	....								
14	6.9	7.2	8.1	9.2	10.2	11.1	12.0	12.7	13.4	14.1	14.8	15.4	16.0	....							
15	7.1	7.4	8.4	9.5	10.5	11.4	12.3	13.1	13.9	14.5	15.2	15.9	16.5	17.1	....						
16	7.4	7.6	8.6	9.7	10.8	11.8	12.7	13.5	14.3	15.0	15.7	16.4	17.1	17.7	18.1	....					
17	7.5	7.8	8.8	10.0	11.1	12.1	13.1	13.9	14.7	15.5	16.3	17.0	17.6	18.0	18.8	19.3	....				
18	7.7	8.0	9.0	10.2	11.5	12.5	13.5	14.3	15.1	15.9	16.7	17.4	18.1	18.8	19.4	20.0	20.5	....			
19	7.9	8.1	9.2	10.5	11.7	12.7	13.7	14.6	15.5	16.3	17.1	17.9	18.5	19.2	19.8	20.3	20.8	21.2	....		
20	8.0	8.3	9.4	10.7	12.0	13.0	14.0	15.0	15.9	16.7	17.5	18.3	19.0	19.7	20.4	21.0	21.6	22.1	22.7	....	
22	8.3	8.7	9.7	11.1	12.4	13.4	14.6	15.6	16.6	17.5	18.3	19.1	19.9	20.6	21.3	22.0	22.7	23.3	23.8	24.9	....
24	8.6	9.0	10.1	11.5	12.9	14.1	15.2	16.2	17.2	18.1	18.9	19.8	20.5	21.4	22.1	22.9	23.6	24.3	25.0	26.2	27.3
26	8.9	9.3	10.4	11.9	13.3	14.6	15.6	16.8	17.9	18.8	19.8	20.7	21.5	22.3	23.1	23.9	24.6	25.3	25.9	27.2	28.4
28	9.2	9.5	10.8	12.3	13.8	15.1	16.3	17.4	18.5	19.3	20.3	21.2	22.2	23.0	23.8	24.6	25.4	26.0	26.8	28.1	29.4
30	9.4	9.7	11.2	12.7	14.2	15.5	16.7	17.9	19.0	20.0	20.9	21.9	22.8	23.7	24.5	25.4	26.1	26.9	27.7	29.2	30.5
32	9.7	10.1	11.5	13.1	14.6	15.9	17.1	18.3	19.6	20.7	21.6	22.5	23.5	24.4	25.3	26.2	27.0	27.9	28.6	30.1	31.6
34	10.0	10.3	11.8	13.2	14.9	16.3	17.7	18.9	20.0	21.1	22.1	23.1	24.0	25.0	25.9	26.8	27.6	28.5	29.4	30.9	32.4
36	10.1	10.6	12.0	13.7	15.3	16.8	18.0	19.4	20.6	21.8	22.8	24.0	25.0	26.0	27.0	27.9	28.7	29.6	30.3	32.0	33.5
38	10.3	10.8	12.3	14.0	15.5	17.0	18.5	19.8	21.0	22.1	23.3	24.4	25.4	26.4	27.5	28.4	29.4	30.3	31.1	32.7	34.2
40	10.5	11.0	12.5	14.1	15.9	17.5	18.9	20.2	21.6	22.8	24.0	25.1	26.2	27.2	28.1	29.1	30.3	30.9	31.8	33.4	34.9
42	10.7	11.3	12.8	14.5	16.3	17.7	19.3	20.6	22.0	23.3	24.4	25.5	26.6	27.7	28.7	29.7	30.7	31.6	32.5	34.2	35.9
44	10.9	11.4	13.0	14.8	16.5	18.1	19.7	21.1	22.4	23.6	24.9	26.0	27.1	28.2	29.3	30.2	31.2	32.1	33.0	34.8	36.5
46	11.1	11.6	13.2	15.1	16.8	18.5	19.9	21.5	22.8	24.2	25.4	26.7	27.9	29.0	30.1	31.2	32.3	33.1	34.0	35.8	37.4
48	11.2	11.8	13.4	15.3	17.1	18.8	20.4	21.8	23.2	24.5	25.9	27.1	28.3	29.4	30.6	31.7	32.7	33.7	34.6	36.4	38.1
50	11.5	12.0	13.6	15.6	17.5	19.2	20.7	22.2	23.6	25.0	26.3	27.6	28.9	30.0	31.1	32.3	33.3	34.3	35.2	37.0	38.7
52	11.6	12.2	13.8	15.8	17.8	19.5	21.0	22.6	23.9	25.5	26.7	28.0	29.2	30.5	31.6	32.8	33.9	34.8	35.9	37.8	39.7
54	11.8	12.4	14.0	16.1	18.0	19.7	21.4	22.9	24.3	25.8	27.3	28.5	29.7	30.9	32.1	33.2	34.2	35.3	36.3	38.3	40.3
56	12.0	12.6	14.3	16.3	18.2	20.0	21.6	23.4	24.9	26.2	27.6	29.0	30.3	31.6	32.9	34.0	35.1	36.2	37.2	39.2	41.1
58	12.1	12.7	14.4	16.6	18.4	20.1	22.0	23.6	25.2	26.4	28.1	29.5	30.9	32.1	33.3	34.5	35.6	36.7	37.5	39.7	41.6
60	12.3	12.9	14.6	16.8	18.7	20.3	22.4	23.8	25.5	27.0	28.6	30.0	31.4	32.6	33.9	35.1	36.2	37.4	38.4	40.6	42.6
62	12.4	13.0	14.9	17.2	19.2	20.8	22.8	24.4	25.9	27.3	28.8	30.2	31.5	32.8	34.0	35.2	36.3	37.5	38.5	40.8	42.9
64	12.5	13.1	15.1	17.3	19.3	21.2	22.9	24.6	26.2	27.7	29.1	30.5	31.8	33.1	34.3	35.5	36.7	37.8	38.9	41.0	43.1
66	12.7	13.4	15.3	17.6	19.6	21.5	23.3	25.0	26.6	28.1	29.6	30.9	32.3	33.6	34.8	36.1	37.3	38.4	39.6	41.9	43.9

Table 2—(Continued)

Side Rectangular Duct—Inches	26	28	30	32	34	36	38	40	42	44	46	48
26	29.5	....										
28	30.5	31.6	....									
30	31.9	33.0	34.2	....								
32	33.0	34.4	35.7	36.9	....							
34	33.9	35.2	36.5	37.7	38.7	....						
36	34.9	36.3	37.6	38.8	39.9	41.0						
38	35.7	37.1	38.5	39.9	41.1	42.3	43.5	....				
40	36.4	37.9	39.3	40.7	42.0	43.2	44.4	45.5	....			
42	37.5	39.0	40.5	41.8	43.1	44.4	45.6	46.8	47.9	....		
44	38.2	39.9	41.4	42.9	44.2	45.6	46.8	48.0	49.1	50.1	....	
46	39.1	40.7	42.2	43.8	45.1	46.4	47.7	49.0	50.1	51.2	52.1	....
48	39.8	41.4	42.9	44.0	45.9	47.3	48.7	50.0	51.4	52.6	53.8	54.9
50	40.4	42.1	43.7	45.3	46.8	48.2	49.7	51.0	52.4	53.6	54.7	55.7
52	41.2	42.8	44.5	46.2	47.5	48.9	50.4	51.7	53.0	54.9	56.1	57.2
54	42.1	43.8	45.5	46.9	48.4	49.9	51.3	52.7	54.0	55.4	56.7	58.0
56	42.9	44.5	46.0	47.7	49.2	50.8	52.2	53.7	55.0	56.4	57.6	58.9
58	43.4	45.0	46.7	48.6	50.1	51.5	53.0	54.5	55.8	57.3	58.5	59.8
60	44.0	45.7	47.4	49.2	50.7	52.5	53.9	55.4	56.6	58.2	59.7	61.1
62	44.5	46.4	48.2	50.0	51.7	53.7	54.7	56.2	57.7	59.1	60.5	61.9
64	45.0	46.9	48.8	50.5	52.3	53.9	55.6	57.2	58.7	60.1	61.6	62.8
66	45.9	47.8	49.6	51.3	53.0	54.6	56.2	57.8	59.4	60.9	62.3	63.8
68	46.6	48.5	50.3	52.1	53.9	55.5	57.1	58.8	60.3	61.9	63.3	64.7
70	46.9	48.9	50.8	52.6	54.4	56.0	57.8	59.6	61.1	62.7	64.2	65.7
72	47.7	49.6	51.6	53.3	55.1	56.8	58.5	60.2	61.8	63.4	64.9	66.4

Side Rectangular Duct—Inches	50	54	60	66	72	78	84	88
50	56.7	....						
52	58.1	....						
54	59.3	61.7	....					
56	60.0	62.4	....					
58	61.9	64.1	....					
60	62.4	65.0	68.2					
62	63.2	65.5	69.4	....				
64	64.0	66.8	70.6	....				
66	65.2	67.9	71.5	75.1				
68	66.1	68.8	72.6	76.7				
70	67.1	69.9	73.6	77.6	....			
72	67.8	70.6	74.5	78.6	81.8	....		
74	68.8	71.5	75.6	80.2	83.3	....		
76	69.8	72.6	76.8	80.6	84.3	....		
78	70.4	73.4	77.7	81.7	85.3	88.5	....	
80	71.3	74.4	78.7	82.6	86.2	89.7	....	
82	72.2	75.3	79.6	83.5	87.2	90.8	....	
84	73.0	75.8	80.1	84.3	88.4	92.1	95.5	....
86	73.7	76.8	81.3	85.6	89.5	93.3	96.8	....
88	74.6	77.8	82.3	86.6	90.5	94.3	97.9	100.2
90	75.3	78.3	82.9	87.2	91.3	95.1	98.9	101.2
92	76.2	79.4	84.0	88.4	92.4	96.4	100.1	103.0
94	77.1	80.2	84.8	89.1	93.3	97.3	101.1	103.5
96	77.7	80.9	85.7	90.1	94.3	98.4	102.2	104.5

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Pres. Gurney Addresses Massachusetts Chapter

October 17, 1938. The Massachusetts Chapter held its first meeting of the season at Walker Memorial, M. I. T. The meeting was preceded by a dinner held in the faculty dining room.

Due to the illness of the president, James Holt, Vice Pres. R. M. Nee presided at the meeting, and the guest speaker of the evening was E. Holt Gurney, Toronto, Can., president of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Past Presidents W. T. Jones and D. S. Boyden were among those at the head table with Mr. Gurney.

President Gurney spoke at length on Society activities and later discussed the topic of Air Conditioning Brings Human Problems to the Engineer.

Among the guests were several officers of the Boston Air Conditioning Bureau.

Patented Air Conditioning Systems Described at Western Michigan

October 10, 1938. The Western Michigan Chapter held its first meeting of the season at the Rowe Hotel in Grand Rapids. Dinner was served at 6:30 p. m. to 45 members and guests.

The meeting was called to order by Pres. C. R. McConner and after roll call by Secy. W. G. Schlichting, minutes of the annual meeting held at Green Ridge Country Club in Grand Rapids, May 19, 1938, were read and approved.

President McConner introduced the speaker of the evening, H. W. Ewald, of Auditorium Conditioning Corp., New York City, who used charts and diagrams to show a few of the many patented air conditioning systems for comfort that are available.

An interesting discussion followed and the meeting was adjourned at 10:30 p. m.

The Flow of Heat Through Walls

By F. E. Giesecke*, (*MEMBER*), College Station, Tex.

THE size of the equipment necessary to air condition a building properly depends very largely on the construction of the building. For example, two buildings may be identical in other respects, but one may have heavy exterior walls through which heat flows slowly and in which large quantities of heat can be stored, while the other may have light exterior walls through which heat flows readily and in which only small quantities of heat can be stored. The former building can be air conditioned with a smaller installation and at a lower annual cost than the latter, because the heavier walls equalize to a greater extent the daily, as well as the seasonal variations in temperature and reduce thereby to a greater extent the maximum heating and cooling loads for which the air conditioning system must be designed.

In order to take proper account of the influence of the heat conductivity and of the heat storage capacity of the exterior walls, when heat-loss and heat-gain computations are made for a building, it is necessary to know how heat flows into, in, and out of such walls.

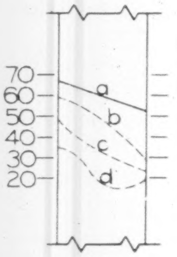

Fig. 1—Thermal gradients

Ordinary heat loss and heat-gain calculations for buildings are based on the assumption that the temperature gradient through a wall may be represented by a straight line. For example, Fig. 1, line *a*, represents the usual assumption of the heat flow through a 12-in. brick wall when the inside temperature is 70 and the outside temperature is 50 F. This assumption is only correct when the inside and outside temperatures remain constant and when they have been constant for a sufficient time for the flow of heat through the wall to have attained a steady state. Whenever the flow of heat through the wall is variable, the temperature gradient can only be represented correctly by a curved line, and, since this flow of heat can vary in an infinite number of ways, the temperature gradient may be represented by an infinite number of differently curved lines, as suggested by lines *b*, *c*, and *d*.

A thorough study of variable heat flow was first made by Prof. J. P. J. Fourier, and a fundamental mathematical treatment was developed by him and published in *Theorie Analytique de la Chaleur*, 1822. This exact mathematical treatment is very complicated and difficult to apply. For ordinary heating problems, it is sufficiently accurate to divide the time into definite intervals and to divide the wall into a definite number of slabs of equal thickness, and to assume that the flow of heat into and through the wall, and the temperatures within the wall change in a series of successive steps and remain constant during the respective intervals of time and space between the successive changes.

This method of studying variable heat flow was developed by Dr. Ernst Schmidt and his analysis published in Dr. August Foppls *Festschrift*, 1924.

The method is briefly as follows:

The differential equation of the flow of heat, in one direction only, in a wall built of isotropic material, as developed by Professor Fourier, is:

$$\frac{\delta\vartheta}{\delta t} = \frac{k}{cw}\,\frac{\delta^2\vartheta}{\delta x^2} \qquad (1)$$

where,

ϑ = temperature, degrees Fahrenheit.
t = time, hours.
k = thermal conductivity of wall, Btu per hour per degree Fahrenheit per foot.
c = specific heat of wall.
w = weight of wall, pounds per cubic foot.
x = coordinate, perpendicular to the surface of the wall, feet.

If small but definite units or increments of time and space, Δt and Δx, are substituted for the differentials δt and δx, and if the temperature remains constant during each time interval, equation (1) may be written with a sufficient degree of accuracy:

$$\frac{\Delta\vartheta}{\Delta t} = \frac{k}{cw}\,\frac{\Delta^2\vartheta}{(\Delta x)^2} \qquad (2)$$

By transforming and indicating the partial character of the temperature differences,

$$\Delta_t\vartheta = \frac{k}{cw}\,\frac{\Delta t}{(\Delta x)^2}\,\Delta^2_x\vartheta \qquad (3)$$

It will be shown that, in order to apply Equation (3) in heat flow calculations, it is advantageous to select values for Δt and Δx which will reduce the terms $\frac{k}{cw}\,\frac{\Delta t}{(\Delta x)^2}$ to one-half. This can always be done by assuming Δx and solving for Δt or assuming Δt and solving for Δx in the equation:

$$\Delta t = \frac{cw}{2k}\,(\Delta x)^2 \qquad (4)$$

For example, for a brick wall having $k = 0.5$, $c = 0.2$, and $w = 125$, if Δx is 2 in., Δt will be 41⅔ min. For a concrete wall, having $k = 1.0$, $c = 0.2$, and $w = 144$, if Δx is 2 in., Δt will be 24 min, or, for a wall of glass or mineral wool having $k = 0.0225$, $c = 0.2$, and $w = 1.5$, if Δx is 2 in., Δt will be 11⅑ min.

Assuming that the proper selection of Δt and Δx will always be made,

$$\Delta_t\vartheta = \frac{1}{2}\,\Delta^2_x\vartheta \qquad (5)$$

In order to understand the meaning of the terms in Equation (5), examine the charts of Figs. 2 and 3.

The chart of Fig. 2 shows the thermal field in a por-

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*Director, Engineering Experiment Station, Texas A. & M. College.
For presentation at the 45th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Pittsburgh, Pa., January, 1939.

tion of the vertical section of a wall as the temperature varies with respect to distance and with respect to time. One of the sections is designated $\vartheta_{n,k}$, this represents the temperature in the unit section which is removed $n \Delta x$ from the *t*-axis and $k \Delta t$ from the *x*-axis. The designations of the adjacent sections are similar.

It is evident from Fig. 2 that,

$$\Delta_t \vartheta = \vartheta_{n,k+1} - \vartheta_{n,k} \qquad (6)$$

The chart of Fig. 3 shows the same thermal field as Fig. 2, but only for one unit of time; it shows how the temperature varies with respect to distance.

It is evident from Fig. 3 that,

$$\Delta_x^2 \vartheta = \vartheta_{n-1,k} + \vartheta_{n+1,k} - 2\vartheta_{n,k} \qquad (7)$$

Substituting from Equations (6) and (7) in Equation (5)

$$\vartheta_{n,k+1} = \frac{1}{2} \left(\vartheta_{n-1,k} + \vartheta_{n+1,k} \right) \qquad (8)$$

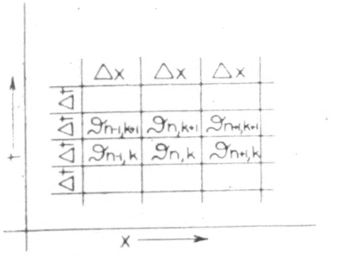


Fig. 2—Thermal field showing variation of temperature with time and with distance

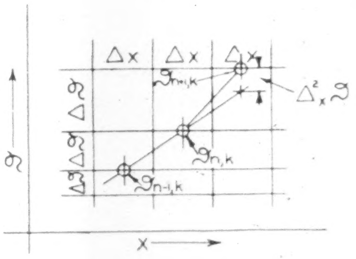


Fig. 3—Thermal field showing variation of temperature with distance only

This shows that if the thermal gradient in a wall is known during any given unit of time k, the thermal gradient during the succeeding unit of time, $k + 1$, is found by taking the arithmetic mean of the temperatures of alternate sections of the given thermal gradient and placing it equal to the temperature of the intermediate section in the required gradient. The required arithmetical mean may be found numerically or graphically. For example, if in Fig. 4 the line *2, 3, 4,* and *5* represents the thermal gradient in a wall during some one unit of time, the points *3′* and *4′*, of the thermal gradient during the next succeeding unit of time, may be found graphically as shown.

This method does not determine the initial point *2′* of the required thermal gradient. To find this point, it may be necessary to calculate (1) the quantity of heat flowing from the second section to the first section (knowing the temperature difference and the thermal conductivity); (2) the quantity of heat flowing from the first section to the air (knowing the temperature difference and the film coefficient); (3) the net loss of heat by the first section; and (4) the reduction in temperature of the first section resulting from this net loss. However, instead of making such a long and complicated calculation, the required point can be located graphically with sufficient accuracy by a method based on the following reasoning:

In Fig. 5, let the curve *a b c* represent the temperature gradient in the wall, let *d e* be the tangent to this curve at the point *a*; let dy/dx be the slope of the tangent and therefore the slope of the temperature gradient at the surface of the wall.

Let t_s and t_a denote, respectively, the temperatures of the surface of the wall and of the air adjacent thereto, and let these temperatures be represented graphically as shown in Fig. 5. Let k denote the thermal conductivity of the material of the wall and a the film coefficient. Then the heat flowing from the surface of the wall to the surrounding air will equal $a\,(t_s - t_a)$ Btu per square foot per hour; this quantity of heat is equal to that which flows to the outside wall surface from the wall section immediately adjacent thereto and which is $k \dfrac{dy}{dx}$. Hence,

$$a\,(t_s - t_a) = k \frac{dy}{dx} \text{ and hence,}$$

$$\frac{dx}{dy}(t_s - t_a) = \frac{k}{a}.$$

From the similar triangles *o f a* and *a g e*, it is then evident that $o\,f = \dfrac{k}{a}$

If the point *o* is called the directing point of the tangent to the temperature gradient at the surface of the wall, then: *The directing point is located on the line which represents the average air temperature, during the interval of time under consideration, and at a distance* $\dfrac{k}{a}$ *from the surface of the wall.*

Applying this construction to Fig. 4, the point *2′* may be found as shown in Fig. 6, as follows: Draw the line t_a, representing the average temperature of air in contact with the wall; locate the directing point *o* on that line at a distance $\dfrac{k}{a}$ from the wall; join the points *o* and *2*; draw a line parallel to the surface of the wall at a distance $\dfrac{\Delta x}{2}$ from the wall; the point of intersection of this line with the line *o 2* is the point *1* of the tempera-

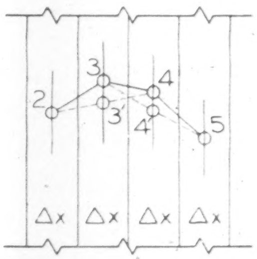


Fig. 4—Method of passing from one thermal gradient to the next succeeding one

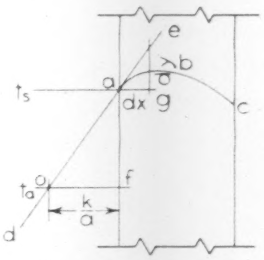


Fig. 5—Method of locating directing point of tangents to thermal gradients

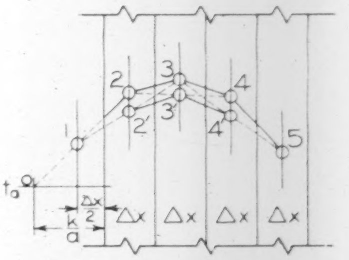


Fig. 6—Method of passing from one thermal gradient to the next succeeding one

ture gradient, extended beyond the surface of the wall; join points *1* and *3* to find point *2'*, as shown.

The points *6* and *5'* may be found in a similar manner.

The question will naturally arise, how accurate is this graphical method of determining the flow of heat in solids. To determine this, Dr. Schmidt assumed a concrete wall 15.75 in. thick, heated uniformly to 20 C, and then cooled in air at 0 C, and determined the rate of cooling. The results of this study are shown in Fig. 7, the calculated values by small circles and those secured graphically by straight lines. Both sets of values are given in Table 1.

Table 1—Wall Temperatures in Degrees Centigrade

Time in Hours		2½	5	10	20	50
Wall center	Fourier......	19.70	18.46	15.48	10.68	3.52
	Schmidt.....	19.85	18.42	15.33	10.52	3.03
Wall surface	Fourier......	13.98	12.30	10.08	6.96	2.30
	Schmidt.....	13.98	12.25	10.06	6.90	2.02

It appears from this tabulation that, at the end of 20 hours, the difference between the two results varied only from about 1 to 1½ per cent. Since these results were secured with time increments varying from 37½ min to 2½ hours, it is evident that the graphical method is sufficiently accurate for calculations on which the design of air conditioning equipment is to be based.

The diagram of Fig. 6 may also be used to determine the quantity of heat flowing into the wall, or out of the wall, or from one portion of the wall to the adjacent portions. In every case, heat flows from a region at higher to one of lower temperature. Since the point *2* represents a higher temperature than the point *1*, heat is flowing out of the wall into the adjacent air; the rate of flow is $k\frac{dy}{dx}$ Btu per hour per square foot. The value of *k* is known and the value of $\frac{dy}{dx}$ is shown by the slope of the line *2 1* with the horizontal and is expressed in degrees per foot or degrees per inch, depending on the scales used for the drawing. If point *2* were lower than point *1*, heat would be flowing from the adjacent air into the wall.

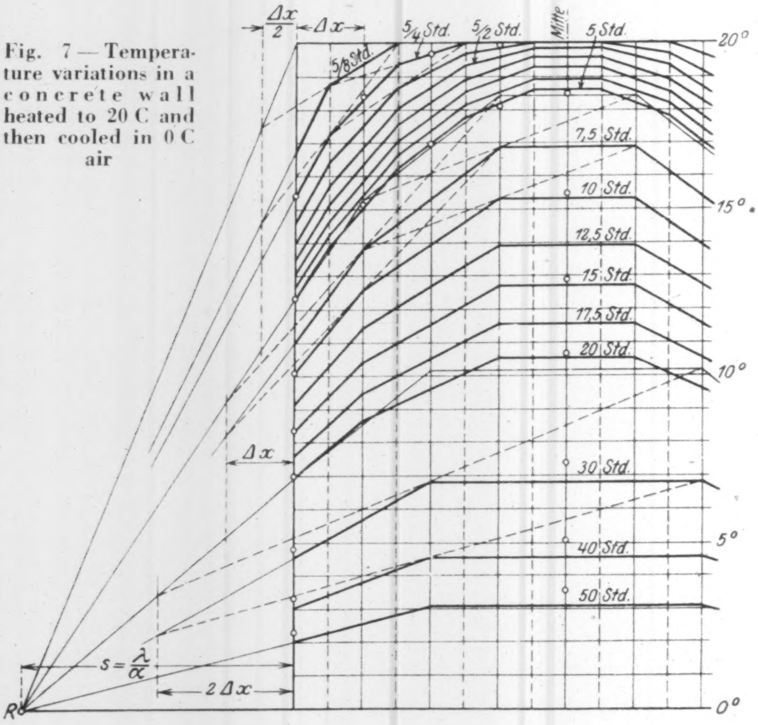


Fig. 7—Temperature variations in a concrete wall heated to 20 C and then cooled in 0 C air

To explain the method of determining the quantity of heat flowing in a wall, consider Fig. 8 and let the lines *A B* and *C D* represent the temperature gradients at the beginning and end of a definite heating period—for example, nine hours. The area *A B C D* will then represent the heat lost by the wall during the nine-hour period. If the average difference of the temperatures shown by the two temperature gradients *A B* and *C D* is 1.4 deg, the wall will have cooled 1.4 deg. If the wall is 12 in. thick, weighs 125 lb per cubic foot, and has a specific heat of 0.2, the heat lost by the wall will be 125 × 0.2 × 1.4, or 35 Btu in the nine-hour period.

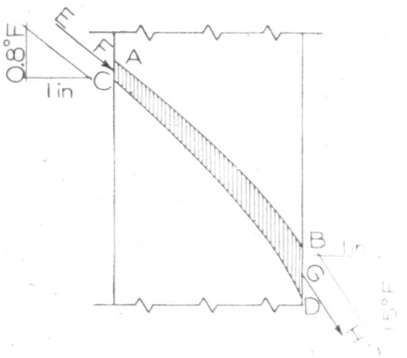


Fig. 8—Method of determining heat lost or gained by a wall

If the line *E F* represents the average of the tangents drawn to the temperature gradients at the inner face of the wall, and if its slope is 0.8 deg per inch, and if the thermal conductivity of the brick wall is 6 Btu per hour per degree Fahrenheit per inch, the quantity of heat which will have entered the wall at *AC* is $k\frac{dy}{dx}$ or 6 × 0.8 × 9, or 43.2 Btu in the nine-hour period.

If the line *G H* represents the average of the tangents drawn to the temperature gradients at the outer face of the wall, and if its slope is 1.5 deg per inch, the quantity of heat which will have passed out of the wall at *B D* is 6 × 1.5 × 9, or 81 Btu in the nine-hour period.

Evidently, the quantity of heat passing out at *D B* (81) must be equal to the sum of the quantities entering the wall at *A C* (43.2) and that lost by the wall during the same period (35). In the case shown in Fig. 8, the quantity leaving the wall is 81 and the sum of the two other quantities is 78.2, or less by 2.8 Btu. This shows that there is an error in the assumptions made in the construction of Fig. 8. One or more of the three calculated values, 43.2, 35, and 81, must be incorrect. If it is assumed that the correct value of the loss of heat by the wall is the average of the two calculated values, or 79.6, the error will be about 1.8 per cent.

To show the practical application of the method described, determine the flow of heat during a 24-hour period through the 12-in. brick wall shown in Fig. 9. The overall heat transmission coefficient of this wall is:

$$U = \frac{1}{\frac{1}{1.65} + \frac{12}{6} + \frac{1}{6}} = 0.361$$

Assume that the indoor air temperature remains at 70 F and the outdoor temperature begins with 50 F at 6 p. m. and varies according to the chart of Fig. 9B.

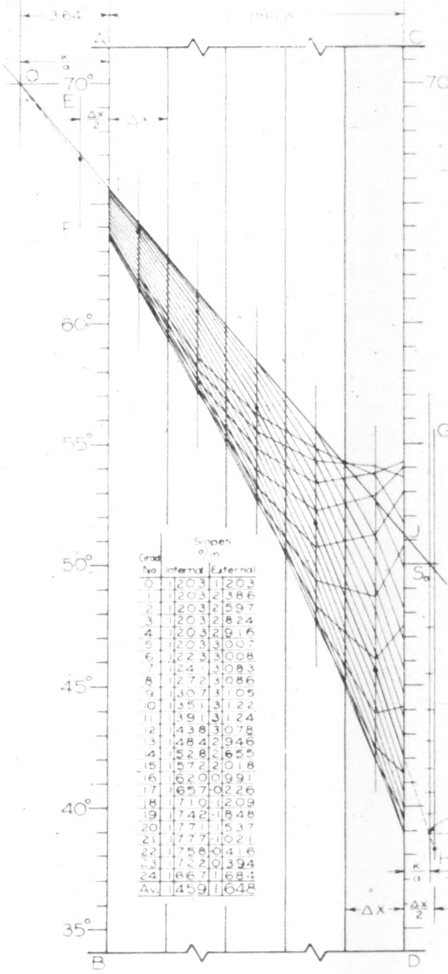
Assume that the indoor and outdoor temperatures of 70 and 50 F have remained constant for a sufficient time so that the initial temperature gradient can be represented by a straight line.

Draw (see Figs. 9A and 9B) (1) a section of the wall *ABCD;* (2) the 70 and 50 F temperature lines *RT* and *KL;* (3) the temperature chart *KMNPL* for the 24-hour period; (4) vertical lines dividing the wall into five slabs of equal thickness (2.4 in.); (5) the median lines of these slabs; (6) the two lines *EF* and *GH* parallel to the faces of the wall and at a distance $\frac{\Delta x}{2}$ from them, and (7) the initial temperature gradient *IJ*.

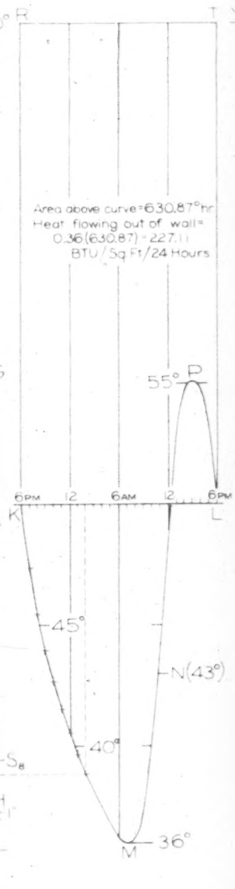
To draw the initial temperature gradient, proceed in the usual way; the three consecutive resistances to heat flow through the wall are $\frac{1}{1.65}$, $\frac{12}{6}$, and $\frac{1}{6}$; the three consecutive temperature drops are proportional thereto, their sum is 20 deg, and they are, therefore, 4.4, 14.4, and 1.2 deg. Set off, in the outer faces of the wall, the two points 70 — 4.4 or 65.6 and 50 + 1.2 or 51.2, and draw the temperature gradient *IJ* through these points.

Or, better and quicker, calculate the distances of the two directing points *O* and S_o from the faces of the wall, $\frac{0.5 \times 12}{1.65}$ or 3.64 in. and $\frac{0.5 \times 12}{6}$ or 1.00 in., set them off as shown and draw the initial temperature gradient through them.

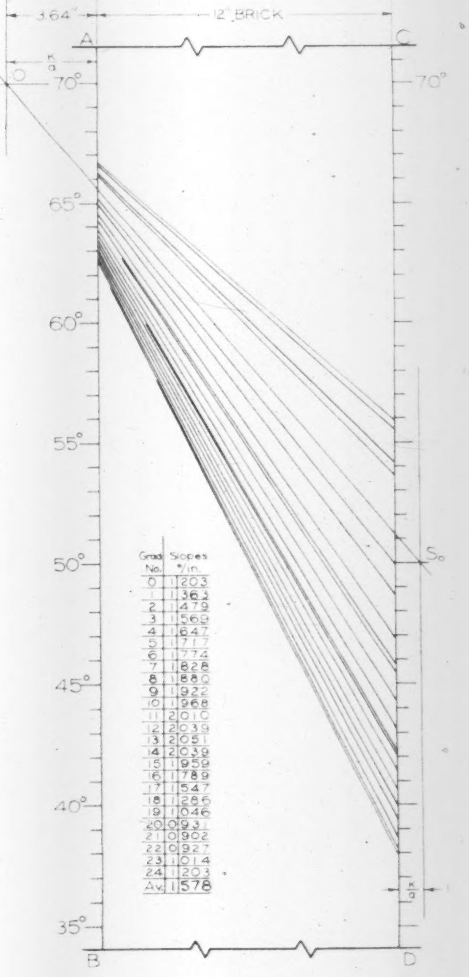
Having assumed Δx as 2.4 in., Δt will be found by Equation (4) to be 60 min. Set off 60-min points along the line *KL* of the temperature chart, draw vertical lines through the division points to intersect the temperature chart and, from the points of intersection, draw



Grad No	Slopes °/in Internal	Slopes °/in External
0	1.203	1.203
1	1.203	2.386
2	1.203	2.597
3	1.203	2.824
4	1.203	2.916
5	1.203	3.007
6	1.223	3.008
7	1.241	3.083
8	1.272	3.086
9	1.307	3.105
10	1.351	3.122
11	1.391	3.124
12	1.438	3.078
13	1.484	2.946
14	1.528	2.655
15	1.572	2.018
16	1.620	0.991
17	1.657	-0.226
18	1.710	-1.209
19	1.742	-1.848
20	1.771	-1.537
21	1.777	-1.021
22	1.758	-0.416
23	1.722	0.394
24	1.667	1.684
Av.	1.459	1.648



Area above curve=630.87°hr
Heat flowing out of wall=
0.36(630.87)=227.11
BTU/Sq Ft/24 Hours



Grad No.	Slopes °/in.
0	1.203
1	1.363
2	1.479
3	1.569
4	1.647
5	1.717
6	1.774
7	1.828
8	1.880
9	1.922
10	1.968
11	2.010
12	2.039
13	2.051
14	2.039
15	1.959
16	1.789
17	1.547
18	1.286
19	1.046
20	0.931
21	0.902
22	0.927
23	1.014
24	1.203
Av.	1.578

LEFT TO RIGHT

Fig. 9A—Accurate determination of the flow of heat through a 12-in. brick wall during a 24-hour period

Fig. 9B—Temperature and degree-hour chart

Fig. 9C—Approximate determination of the flow of heat through a 12-in. brick wall during a 24-hour period

horizontal lines to intersect the vertical line through the directing point S_0, thus determining the consecutive positions of the directing point S_1, S_2, etc. Since the indoor temperature is to remain 70 F, the directing point O does not move from its original position.

Having drawn the initial temperature gradient and having the permanent location of the directing point O, and the consecutive locations of the directing point S, draw the required 24 temperature gradients as shown and as explained for Figs. 4 and 5. For example, at 2 a. m. the outdoor temperature is about 39 F, the directing point is S_8, and the temperature gradient is the one marked by small circles. As each successive temperature gradient is drawn, measure the slopes of the two tangents and record them as shown in the table in Fig. 9A.

Find the averages of these slopes (by Simpson's Rule) to be, respectively, 1.459 and 1.648 deg per inch. Accordingly, the heat entering the wall from the room is 210.1 Btu and the heat leaving the wall to the outdoor air is 237.3 Btu in the 24-hour period. Next, and as explained for Fig. 8, determine the average drop in temperature of the wall, as shown by the difference between the initial and final temperature gradients, to be 1.40 deg and, from that, the loss of heat by the wall during the 24-hour period to be 35 Btu.

Adding the 35 Btu lost by the wall to the 210.1 Btu received by the wall from the room, gives 245.1 Btu as the total loss of heat by the wall. However, according to the tangents to the several temperature gradients at the outer face of the wall, the total loss is 237.3 Btu. The difference of 7.8 Btu between these two values represents an error in the construction. If the true value of the heat loss is the average of the two determined values, the error of construction is 1.6 per cent, which is sufficiently low to permit the use of this graphical method in engineering calculations.

However, it seems that if the wall were divided into slabs thinner than 2.4 in. and the time divided into units shorter than 60 min, the error should be smaller, and that the error should approach zero as the space and time intervals are made smaller and smaller.

To try this out, diagrams were constructed like that of Fig. 9 but with the wall divided into six and seven slabs, respectively, so that the slab thicknesses were 2 and $1\frac{5}{7}$ in. and the time intervals were $41\frac{2}{3}$ and $30\frac{30}{49}$ min, respectively. Calculations were made as for Fig. 9, and the results, corrected to the 24-hour period, were secured as given in Table 2.

The results of these three determinations are so nearly identical that the differences may be accounted for by inaccuracies in the graphical constructions. It follows that there may be a considerable variation in the thickness of the slabs into which the wall is divided without materially affecting the results. This conclusion is supported by the data of Fig. 8 in which the slab thickness was doubled without producing serious inaccuracies.

Table 2—Heat Losses Through Walls

DIVISIONS	FIVE	SIX	SEVEN
Heat received from inside..	210.1	211.3	212.8
Heat lost by wall.........	35.0	34.3	34.9
Sum of the two..........	245.1	245.6	247.7
Heat lost to outside.......	237.3	235.2	235.5
Differences...............	7.8	10.4	12.2

To test the accuracy of the graphical construction from another angle, connect the outdoor temperature chart $K\ M\ N\ P\ L$ of Fig. 9B to the indoor 70 F temperature line $R\ T$.

The chart $K\ R\ T\ L\ P\ N\ M$ shows the number of degree hours, 630.87, during the 24-hour period. The heat loss through the wall, as usually calculated, is 630.87 0.36 or 227.1 Btu in 24 hours, per square foot of wall surface. This is 14.1 Btu or about 6 per cent less than that determined graphically. The question arises, which of the two values is more nearly correct.

To study this question, construct the 25 thermal gradients, corresponding to the 25 thermal gradients of Fig. 9A, as shown in Fig. 9C, in accordance with the formula:

$$H = A\ (t - t_o)$$

where,

H = Heat transmitted, Btu.
A = Area of wall, square feet.
= Overall coefficient of heat transmission, Btu per hour per square foot per degree Fahrenheit.
t = Temperature of inside air, degrees Fahrenheit.
t_o = Temperature of outside air, degrees Fahrenheit.

These gradients indicate that the quantity of heat flowing out of the wall at any instant is equal to that flowing into the wall at that instant.

By measuring the slope of each gradient and recording it, as shown in Fig. 9C, calculating their average 1.578 and multiplying by K the conductivity, 6, and by t the time, 24 hours, it is found that the heat flowing through the wall is 227.2 Btu in 24 hours, or the same as that determined from the degree-hour chart of Fig. 9A, as it should be.

Evidently, the calculated value of 227.2 Btu is based on the assumption that during every instant the quantity of heat flowing out of the wall is equal to the quantity of heat flowing into it. This would be approximately true in a wall consisting only of a thin sheet of metal having practically no heat storage capacity. In all walls, as ordinarily built, there is a considerable heat storage capacity, and the heat stored in the wall varies continuously as the indoor or outdoor air temperatures vary and as the temperature of the wall is influenced by solar radiation. For this reason, the quantity of heat flowing out of the wall will generally vary materially from that flowing in at the same instant.

For the particular conditions assumed for the 24-hour period under study, the average temperature of the wall was higher at the beginning than at the end of the 24-hour period. The quantity of heat lost by the wall in cooling during the 24-hour period, about 35.2 Btu, must be included in the heat loss calculations for the building.

Having completed the graphical studies of the flow of heat through a 12-in. brick wall as shown in Figs. 9A and 9C, similar studies were made for an 8-in. and for a 16-in. brick wall. The final results of these studies are shown in Fig. 10. Hereafter, the graphical method (Fig. 9A) will be designated the accurate method, be-

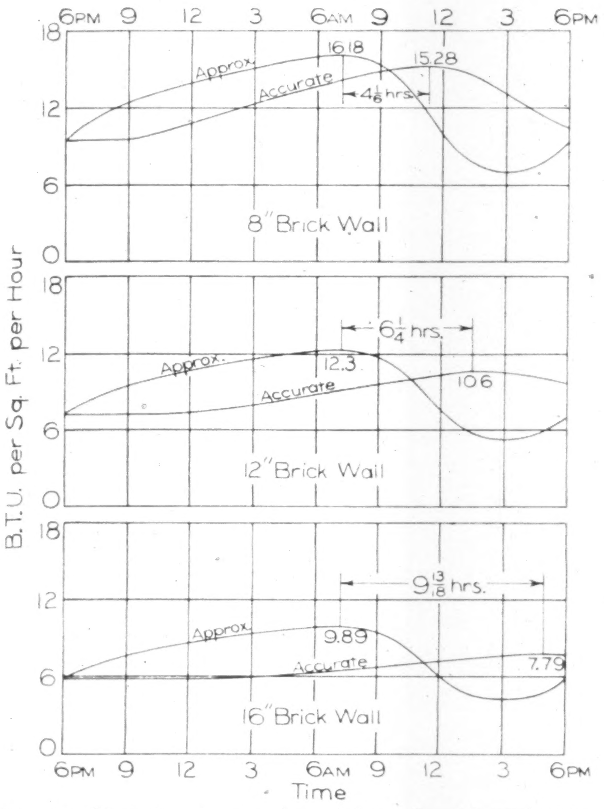


Fig. 10—Variation in time-lag of heat flow through 8-in., 12-in., and 16-in. brick walls

cause it is based on the heat storage capacity as well as on the heat conductivity. The method in general use at this time (Fig. 9C) will be designated the approximate method because it is based entirely on the heat conductivity of the materials composing the wall.

To compare the results secured by the accurate method with those secured by the approximate method, construct Fig. 10 to show the varying rates of heat flow from the room into the wall based on the slopes of the respective tangents as recorded in Figs. 9A and 9C for the 12-in. wall.

It appears from Fig. 10 that the maximum flow of heat from the room into the wall is less according to the accurate method than according to the approximate method, and that considerable time passes before the maximum flow occurs. This time lag increases with the thickness of the wall and varies from about 4 hours for an 8-in. wall to about 10 hours for a 16-in. wall.

Time lag has a very important bearing on heat flow calculations, especially when the cooling load resulting from solar radiation is to be determined.

In the past, heat flow calculations for buildings were restricted largely to the determination of heating loads and large portions of walls were replaced by windows and doors so that the heat loss through walls formed a comparatively small portion of the total heat loss of a building, and, consequently, the use of a scientifically incorrect method of heat flow calculation caused no serious harm.

At present, and probably for some time in the future, conditions are and will be quite different. With present-day improved lighting and ventilating systems, the proportion of wall spaces occupied by windows and doors is greatly reduced and the calculated heat loss through walls forms a much larger portion of the total heat loss than it did formerly. In addition, with the advent of air conditioning, heat flow calculations to determine cooling loads are probably more common and more important than those to determine heating loads, and it is more important than ever before to know the time lag in the flow of heat through walls which results directly from the heat storage capacities of the walls. For these reasons, it is important to abandon the present method of heat flow calculation and to develop a method which takes into account the thermal capacities as well as the thermal conductivities of the materials composing the walls.

When this shall have been done, a better opportunity than now exists will be provided for the cooperation of the architect and the heating engineer, so as to produce buildings with those types of walls, floors, and roofs which, when combined with the necessary air conditioning equipment, will give the owner the most economical plant in first cost as well as in cost of operation and maintenance.

In order to make the calculations presented in this paper as simple as possible, they were based on a wall of uniform material throughout. In actual building construction, walls are of a composite nature.

The flow of heat through such composite walls can be traced by the graphical method presented above, but the construction is slightly more complicated. Illustrative examples are not submitted for lack of space and time.

So far, the discussion has been based entirely on theoretical reasoning. To compare the results secured with those which may be expected in actual installations, resistance wires were placed in a 13-in. brick wall so that the flow of heat into and through the wall could be measured. The wall is shown in Fig. 11; the resistance wires were placed in the two wall sections marked by black ribbons. Two sets of wires were placed so that by shielding one section of the wall from the sun's rays while the other section was exposed thereto, simultaneous temperature readings could be taken in the two sections and, in that way, the effect of direct solar radiation could be determined.

The wall was the southwest wall of an addition to the A. & M. College Exchange Store, erected in August 1938,

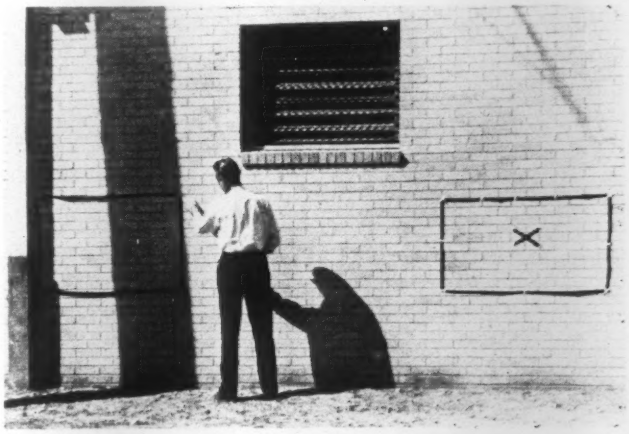


Fig. 11—Wall used in experimental determination of heat flow

and was built of common gray brick laid in cement-lime mortar.

Each set of wires (Fig. 12) consisted of 10 pairs of No. 20 enamel-covered copper wire; the two outer pairs were within ½-in. of the wall surface and the other eight pairs were spaced equally between them. Each pair consisted of one wire 125 ft long and one 25 ft long so as to eliminate end conditions and so as to have 100 ft of wire in the plane of the wall in which the temperature was to be measured.

The first temperature readings were taken about six weeks after the wall had been built. The upper chart of Fig. 13 shows how the temperature varied from 8 a. m. to 11 p. m. in Wires 1, 6, and 10; and also how the temperature varied during that period within the building and outdoors.

The lower chart of Fig. 13 shows five of the temperature gradients through the wall as determined by means of the 10 resistance wires.

Much valuable information can be secured from the two charts. For example:

(1) The upper chart shows clearly how the heat wave enters the outer surface of the wall, is gradually reduced by the heat absorption of the wall, and reaches the inner surface very much diminished, since Wire 1 attains its maximum temperature, 99, at 11:30 a. m., Wire 6 attains its maximum temperature, 85, at 6 p. m., and Wire 10 attains its maximum temperature, 80, at 9 p. m.

(2) The lower chart shows that, at 10 a. m., heat is flowing into the wall from outdoors at a rate of 36 Btu per hour per square foot (since the slope of the tangent to the 10 a. m. gradient is 6 deg per inch which, for a conductivity of 6, gives 36 Btu) and flowing out of the wall into the building at a rate of 10 Btu per hour per square foot (since the wall surface temperature is 78 and the room temperature 72; the difference, 6, with a film coefficient of 1.65, gives 10 Btu).

(3) When the temperature readings were taken the wind velocity was very low, not above 5 mph; for this velocity, the outdoor film coefficient is about 3. For this value and a value of 6 for the conductivity of the brick work (Fig. 5) the directing point of the gradient tangent is 2 in. from the face of the wall, and at 10 a. m. it is on the 84 F temperature line.

It appears from the lower chart that the 10 a. m. gradient tangent extended would intersect the directing point line near the 107 F temperature line, or about 23 deg above the usual location of this directing point. This shows that, for this particular wall and for this particular time, it is necessary to add approximately 23 deg to the outdoor temperature in order to account for the additional heat which enters the wall as a direct result of thermal radiation, if the heat flow calculation is to be made in the usual manner.

In studying these charts it must be borne in mind that the brick wall was only six weeks old when the temperature readings were taken. It is very likely that

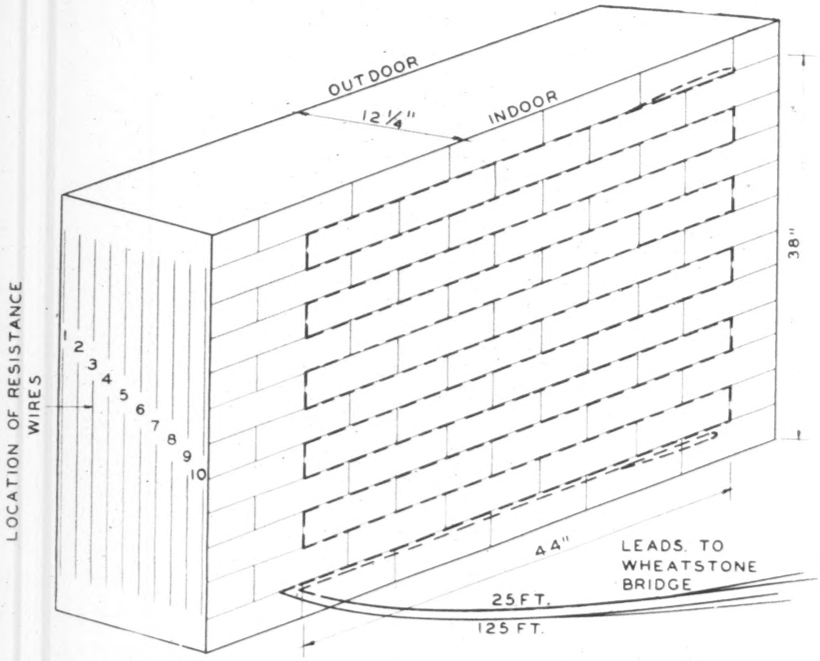


Fig. 12—Arrangement of resistance wires in wall for experimental determination of heat flow

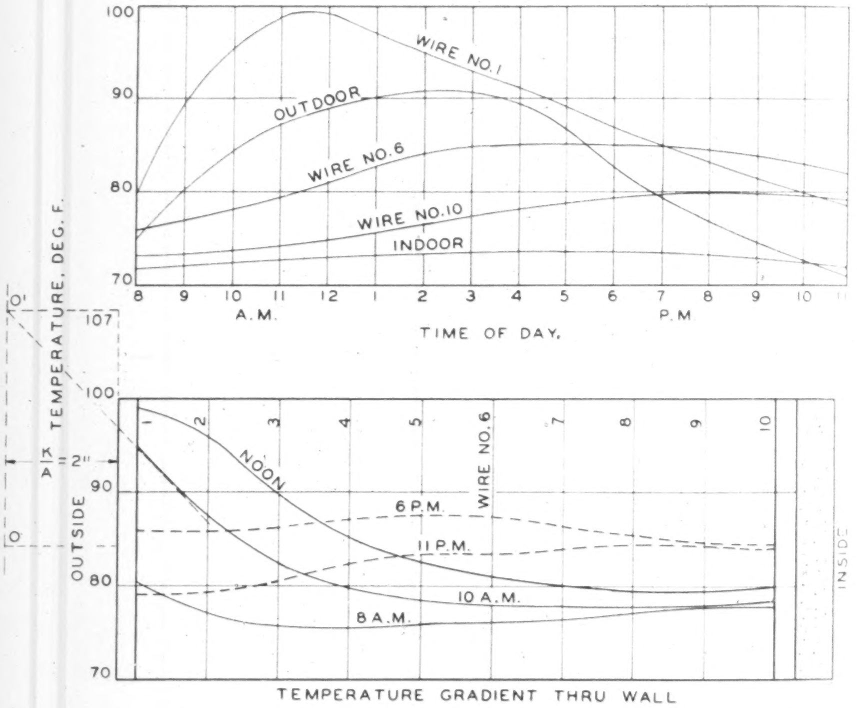


Fig. 13—Temperature curves and temperature gradients derived in experimental determination of heat flow through wall

chemical and physical changes resulting from the setting of the mortar were still taking place and were probably affecting the temperature distribution within the wall. For this reason, observations were discontinued and will be resumed during the summer of 1939 when it should be possible to secure valuable data from this set-up.

Summary

1. Attention is called to the importance of considering the heat storage capacities as well as the heat conductivities in calculations relating to the heating and cooling loads for air conditioning.
2. An accurate graphical method, developed by Dr. E. Schmidt of Danzig, for tracing the flow of heat in and through walls is presented.
3. The flow of heat through a 12-in. brick wall during a 24-hour period is determined by the graphical method.
4. The variation in time-lag in the flow of heat with different types of walls is shown.
5. Preliminary results of an experimental study of the flow of heat through a 12-in. brick wall are given.

Acknowledgments

The author is indebted to R. O. Loving, Instructor in Engineering Drawing, Texas A. & M. College, W. H. Badgett, Research Assistant, Engineering Experiment Station, Texas A. & M. College, and G. C. Kershaw, Laboratory Assistant, Engineering Experiment Station, Texas A. & M. College, for valuable assistance. Mr. Loving prepared all graphical constructions and made all calculations and drawings incident thereto. Mr. Badgett and Mr. Kershaw prepared the resistance wires and placed them in the wall as shown in Fig. 12; they also made the temperature observations and constructed the charts of Figs. 12 and 13.

Talk and Movie Presented to Western Michigan

November 7, 1938. The Western Michigan Chapter met at the Elks Club, Grand Rapids, and dinner, preceding the meeting, was served at 6:45 p. m. to 55 members and guests.

Pres. C. R. McConner called the meeting to order, and after roll call by the secretary, minutes of the October meeting were read and approved. A short business meeting followed, and included a short discussion in regard to the proposed change of the Constitution and By-Laws of the Western Michigan Chapter.

President McConner introduced the speaker of the evening, W. S. Warnock, American Rolling Mill Co., who gave an interesting talk on the many uses of steel and the special requirements of industry which necessitated the development of new types of steel. Mr. Warnock then showed a sound film entitled The Romance of Iron and Steel, which was very instructive.

The meeting adjourned at 9:45 p. m.

Housing Discussed at Western New York Meeting

November 14, 1938. The Western New York Chapter held its November meeting at the University Club, Buffalo, with 52 members and guests attending. Minutes of the October meeting were read and approved. During roll call each member arose and gave his name and business.

Treas. H. C. Schafer, in the absence of Secy. W. R. Heath, read an announcement of a four-day seminar on Air Conditioning to be held November 28 to December 1 at the University of Minnesota, Minneapolis.

Past Pres. D. J. Mahoney, chairman of the Christmas party, announced plans for bowling on December 20 at the University Club.

Pres. J. J. Landers then turned the meeting over to Past Pres. Joseph Davis who introduced the guest speaker, C. E. Mayette, consulting engineer, New York City, former chief mechanical engineer, U. S. Housing Authority. Mr. Mayette chose as his subject, The Position of Consulting Engineer in the Housing Problem, and very ably outlined the various heating methods used in large housing projects and the many problems confronting the consulting engineer in this work. He explained that each project had its own individual problems and mentioned how some of these difficulties were overcome and solved. The address was well presented and the speaker was accorded a rising vote of appreciation.

After an informal discussion on the subject, the meeting was adjourned.

Death of Wm. P. Boddington

Members of the Society who knew William P. Boddington will be shocked by the news of his untimely death, on November 17, from pneumonia.

He was manager of the Canadian Powers Regulator Co., Ltd., and a heavy cold, contracted before a recent visit to his company's plant in Chicago, proved to be very serious. Upon his return to Toronto, he entered the hospital, but all efforts to save his life were in vain.

W. P. Boddington

Mr. Boddington was born in Toronto, August 26, 1889, and attended the public schools of that city. In his early 'teens he was an apprentice with Purdy Mansell Co., Ltd., after which he spent two years with Cramps Shipbuilding Co., Philadelphia; then with Westinghouse, Church, Kerr Co., in charge of the erection of heating and power plants; and during the war he was with Canadian Electric Products Co., Shawanigan Falls.

In 1919 he joined the Canadian Powers Regulator Co., Ltd., and was shortly placed in charge of their Canadian interests, which position he held until his death. For nearly 20 years he has supervised some of the largest installations in important buildings in Canada.

Mr. Boddington became a Member of the A. S. H. V. E. in 1927, and was always active in the work of the Ontario Chapter, of which he was President during 1933-34. Many members who attended the Society's 1935 meeting in Toronto remember Bill Boddington's work as Chairman of the Entertainment Committee.

Mr. Boddington loved outdoor life and was an ardent member of the Anglers' Club; he was an enthusiastic lawn bowler and belonged to the Boulevard Club and was a noted dinghy sailor and canoeist with the Toronto Canoe Club. Mr. Boddington was a loyal member of Rotary and was actively connected with the Crippled Children's Committee.

The Officers and Council express their sincere sympathy to his family who survive, Mrs. Boddington, and two sons, Jack and William C., two sisters and two brothers.

Interment was in Park Lawn Cemetery, Toronto, following funeral services on Saturday, November 19, at Matthews Funeral Chapel.

CORRELATING THERMAL RESEARCH

As a part of the efforts of the A.S.H.V.E. Research Laboratory to correlate research in thermal engineering carried on by the many institutions engaged in such work, and to disseminate the published results of such studies together with other reports of progress in the field, and in order to make this information available to the membership of the Society, there is published monthly on this page a limited number of brief abstracts of articles which it is believed will be of interest to all concerned. For more complete lists address the Librarian, A.S.H.V.E. Research Laboratory, U. S. Bureau of Mines Experiment Station, Pittsburgh, Pa.

F. C. Houghten, *Director.*

W. L. Fleisher, *Chairman*
COMMITTEE ON RESEARCH

Essentials in Hot Water Circulation, by Thomas H. F. Holman. *Journal of the Institution of Heating and Ventilating Engineers,* Vol. 6, No. 66, Aug. 1938, pp. 279-301. Discussion of the basic principles governing hot-water circulation, method of calculating the various functions of the flow; points determining *good* and *bad* layout and some examples of unusual or unconventional circuits.

●

Air Conditioning with Particular Attention to Effective Temperatures, by W. L. Fleisher. *Journal of the Institution of Heating and Ventilating Engineers,* Vol. 6, No. 65, July 1938, pp. 255-275. Discussion of air conditioning practice in the U. S. with particular attention to effective temperature and the use of the psychrometric chart. Paper given before the British *Institution of Heating and Ventilating Engineers.*

●

The Economics of Air Conditioning, by H. A. Milnes. *The Journal of the Institution of Heating and Ventilating Engineers,* Vol. 6, No. 66, Aug. 1938, pp. 311-319. Discussion of air conditioning for comfort and for manufacturing processes and the economic value of these installations.

●

Effect of People on Ion Content of the Air, by Dr. G. R. Wait. *Heating and Ventilating,* Vol. 35, No. 9, Sept. 1938, pp. 25-28. Report of study to determine the number of particles, *condensation nuclei,* in the air caused by persons or process changes in the room. These particles are the matter around which the water vapor of the atmosphere collects.

●

Installing Single-Retort Stokers, by L. N. Rowley. *Power,* Vol. 82, No. 10, Oct. 1938, pp. 86-87. Good stoker results depend on fitting the stoker to load requirements and setting the stoker properly in the furnace.

●

Some Heating System Faults and Remedies, by William T. Esttick. *Power Plant Engineering,* Vol. XLII, No. 10, Oct. 1938, pp. 654-6. Discussion of certain faulty heating systems and remedies for the various piping difficulties.

●

The V. D. I. Steam Tables, by Joseph H. Keenan. *Mechanical Engineering,* Vol. 60, No. 10, Oct. 1938, pp. 756-757. Discussion of and explanation of some features of the V. D. I. steam tables prepared by We Loch published in the *Verein Deutscher Ingenieure.*

●

Measurement of Fuel Size, by V. J. Altieri. *American Gas Association Monthly,* Vol. 20, No. 7, July-Aug. 1938, pp. 280-282. A method of size measurement of coal to verify the impression of appearance secured by inspection. Domestic cokes receive particular attention.

●

Principles of Ventilation, by O. W. Kothe. *The Snips,* Vol. 7, No. 7, Sept. 1938, pp. 12-13. Discussion of gravity ventilation, the result of difference in temperature between the inside of a building as compared with the outside temperature. Diagrams show air movement in a building with a roof ventilator.

Ventilating a Residence Kitchen, by R. F. Jeske. *American Artisan,* Vol. 107, No. 9, Sept. 1938, pp. 46-47. Discussion of type of ventilation apparatus suited for kitchen ventilation and the proper placing of the fan. Apparatus should be quiet.

●

Fire Hazards in Ventilating Systems. *American Artisan,* Vol. 107, No. 9, 1938, pp. 47-49. Amendments to pämphlet No. 90 *N. F. P. A. The National Fire Protection Association* adopts amendments to the regulations for fire prevention in air conditioning and ventilating systems, also warm air heating systems in residences.

●

Dynamic Control of Fluid Flow, by K. D. McMahan. Abstract in *Journal of Applied Mechanics,* Vol. 5, No. 3, Sept. 1938, pp. A-115. Paper read before the Fifth International Congress of Applied Mechanics, Cambridge, Mass., Sept. 12-16, 1938. In the past, variable control of fluid flow has been accomplished by means of mechanical parts such as valves, dampers, etc.; now it is possible with simple structures to make use of the dynamic or velocity heads of the flowing fluid to accomplish many of these control functions without the use of moving parts.

●

The Influence of Pressure on Heat Transfer in Evaporation, by Max Jakob. Abstract in *Journal of Applied Mechanics,* Vol. 5, No. 3, Sept. 1938, pp. A-111. Paper presented before the Fifth International Congress of Applied Mechanics, Cambridge, Mass., Sept. 12-16, 1938. Based on a theoretical concept of the process of evaporation, and on experiments, carried out with water and with carbon tetrachloride, boiling at atmospheric pressure, a formula for heat transfer in violent evaporation has been derived and published by M. Jakob and W. Linke in 1935. The purpose of this paper is to demonstrate how this formula can be interpreted and modified in order to be applied also to much lower and higher pressures.

●

Concepts of Efficiency of Heat-transfer and Pressure-drop Relations in Heat Exchangers, by R. H. Norris. Abstract in *Journal of Applied Mechanics,* Vol. 5, No. 3, Sept. 1938, pp. A-119. Paper read before the Fifth International Congress of Applied Mechanics, Cambridge, Mass., Sept. 12-16, 1938. A fundamental method which simplifies performance comparison of different types of heat exchangers for forced-flow fluids. The method also facilitates improvement of any given type of heat exchanger by showing clearly how the performance differs from an ideal performance, and which features are most responsible for the errors

●

Absorption Refrigeration for Summer Air Conditioning with Gas, by W. F. Friend. *American Gas Association Monthly,* Vol. 20, No. 7, July-Aug. 1938, Industrial Gas Section, pp. 275-278. Discussion of absorption refrigeration unit and comparison of hourly operating cost with dichlorodifluoromethane compression system. New design features.

●

Forced Hot Water. *Domestic Engineering,* Vol. 152, No. 4, Oct. 4, 1938, pp. 44-46. Description of a zone control hot water heating system for a seven-family apartment building. The equipment includes an oil-burning water-tube boiler, with the quivalent of seven smaller hot water heating systems taken off he boiler. Advantages of this system are satisfied tenants and conomy in heating cost.

◆

The Supply and Use of Solid Fuels for Domestic Purposes in Great Britain. *The Colliery Guardian,* Vol. CLVII, Sept. 16, 1938, pp. 493-495. Discussion of supply and use of coal in Great Britain, for domestic heating. Types of domestic appliances used, variety of solid fuel in use, the amount used per day in open fire and stoves. Methods of purchasing fuel.

◆

Glass Blocks for Those Who Work in Glass. *Mill and Factory,* Vol. 22, No. 5, 1938, p. 5. The Owens-Illinois Glass Co. uses glass block in the construction of the locker room for its employees. Vacuum characteristics of the block provide insulation against both heat and cold, and it is non-transparent, providing diffused light.

◆

Ultra-violet Transmission of Sheet Glass, by V. Ctyroky and M. Fanderlik. *Sklarske Rozhledy,* Vol. 15, pp. 51-58, 1938. The ultra-violet light transmission of 10 sheet glasses 5 to 7 mm thick was determined using a Hilger medium quartz spectrograph and a photometer. Results are given in tabular form and in spectral transmission curves and show that such glasses permitted ultra-violet transmission. Five of the glasses transmitted much ultra-violet light, with a biological efficiency ranging from 10 to 30 per cent.

◆

Glass Wool, by V. M. Bukhman. *Prom. Org. Khim.,* Vol. 4, pp. 617-619, 1937. Discussion of the production and uses of glass wool.

◆

Rock Wool Industry Grows in Canada. *Stone,* Vol. 59, No. 2, p. 62, 1938. Five plants using limestone as the raw material are in operation and the erection of several others is proposed. The production capacity is 50 tons daily.

◆

The Insulation of Radiant Heat, by Dr. Samuel Richard Cook. *Ice and Refrigeration,* Vol. XCV, No. 5, Nov. 1938, pp. 307-309. Theoretical discussion of insulation of radiant heat by reflection, absorption and transmission. The three coefficients are amenable to experimental determinations either directly or by elimination. They are usually functions of the frequencies of the incident radiations, which may be determined. Value of coefficients of reflection, absorption and transmission for insulating materials would be valuable to the designing engineer.

◆

Designed Air Diffusion, by J. K. M. Pryke. *Heating and Ventilating Engineer,* London, Vol. 12, No. 134, p. 52, Aug. 1938. Discussion of author's experience in air diffusion. Particular attention is given to grilles, their shape, free air openings, diffusion angle, distance of "throw," speed of air at grille outlet and in rooms, and noise and its avoidance.

◆

Heat Transmission Through Walls, by H. Sheard. *Journal of the Institution of Heating and Ventilating Engineers,* Vol. 6, No. 67, Sept. 1938, pp. 360-370. Results obtained in the Heat Transmission Laboratory, England, on heat transmission through several walls including a glass block wall and a brick wall with a single- and double-glazed window.

◆

Properties of Brick and Their Most Effective Utilization, by H. Hecht. *Tonind. ZTG,* Vol. 62, No. 9, pp. 207-212, 1938. Discussion in detail of the properties of brick, such as strength, permeability to air and water and thermal and acoustical insulation. The standardization of these properties and methods of testing.

◆

Possibilities for Utilization of Pulverized Coal Ash, by A. W. Thorson, and John S. Nelles. *Mechanical Engineering,* Vol. 60, No. 11, Nov. 1938, pp. 845-851. It is shown that fly-ash may be used for filler in asphalt paving, in fertilizer, paint and putty, as an aggregate in Haydite concrete and in cinder concrete. It can also be used as a raw material in manufacture of Portland Cement.

◆

Thermal Storage, by A. J. Smith. *Journal of the Institution of Heating and Ventilating Engineers,* Vol. 6, No. 67, Sept. 1938, pp. 329-359. Discussion of the storage of heat during periods when there is an abundance of it or the fuel for producing it is cheap, for use under opposite circumstances. Water is best medium for storage. Electrode boilers used on off-peak electric current tends to economy of heating. Design of heat storage system and cost using electricity, gas or coke. Degree-day map for England.

◆

Automatic Heat. *Domestic Engineering,* Vol. 152, No. 5, Nov. 1938, pp. 40-41. Calculation for boiler load with proper allowance for boiler efficiency on the basis of CO_2 readings and flue temperature.

◆

Automatic Combustion Control Systems. *Instruments,* Vol. 11, No. 10, Oct. 1938, pp. 228-254. Description of the following automatic combustion control systems, each by an engineer associated with it. The Askania System. The Bailey Meter System. The Bristol System. The Brook System. The Brown System. The Cash System. The DFC System. The Dexter-Goebel System. The GE System. The Hagan System. The Hays System. The Metermax System. The Valveless System. The R-K System. The Shall-Cross System. The Smoot System and the Westinghouse System.

◆

Pressure Losses Resulting from Changes in Cross-Sectional Area in Air Ducts, by A. P. Kratz and J. R. Fellows. *University of Illinois Bulletin* No. 300, Feb. 25, 1938. Report of tests conducted at University of Illinois Engineering Experiment Station.

◆

Factors Involved in the Selection of Mechanical Draft Fans, by W. S. Patterson. *Combustion,* Vol. 10, No. 2, p. 21. A discussion of the factors to be considered in calculating the capacities of forced draft fans, induced draft fans, over-fire air fans, pulverizer exhausters, vent fans and primary air fans.

◆

Influence of Steam-flow Metering Equipment on Piping Design, by R. M. Van Duzer, Jr. *Mechanical Engineering,* Vol. 60, No. 11, Nov. 1938, pp. 834-836. Discussion of piping layout in large power plants when steam flow metering is used.

◆

The Commercial Storage of Fruits, Vegetables and Florist Stocks, by Dean H. Rose and R. C. Wright. *U. S. Dept. of Agriculture, Bureau of Plant Industry, Circular No.* 287, April 1938. Cold storage conditions for various fruits and vegetables. Optimum temperature, relative humidity and length of time product will keep in storage are given.

◆

Absorption Cycle Refrigeration Modernizes Department Store, by D. M. Mayne. *Heating and Ventilating,* Vol. 35, No. 10, Oct. 1938, pp. 26-29. Description of absorption refrigeration system for both summer and winter air conditioning, with low-pressure steam.

◆

The Influence of Air Conditions on Human Health and Comfort, by C.-E. A. Winslow. *Ice and Refrigeration,* Vol. 95, No. 5, Nov. 1938, pp. 313-314. Discussion of transmission of disease by air borne bacteria, also desirable atmospheric conditions for various types of human activity.

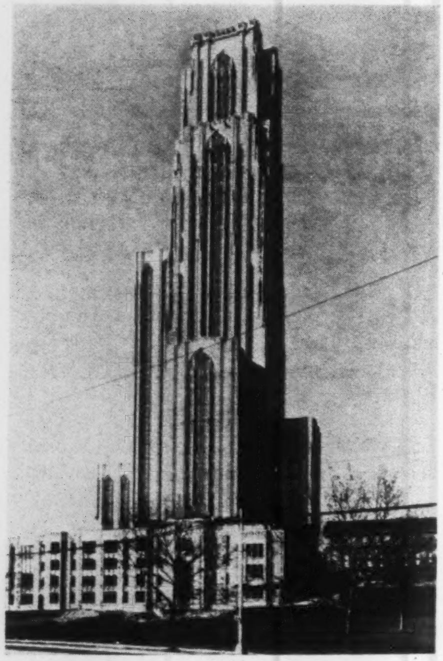
◆

Air Filtration, by Dr. Tell Nelson. *Journal of the American Medical Association,* Vol. 111, No. 14, Oct. 1, 1938, pp. 1298-1301. Discussion of methods of removing impurities from the air, usually in the form of dust. The benefits derived from such treatment of the air are of importance in industry and in the control of many respiratory diseases.

◆

Carbon Monoxide Poisoning in Industry and Its Prevention, by Dr. May R. Mayers, *New York State Department of Labor, Special Bulletin* No. 194. Discussion of garage ventilation.

Pittsburgh Ready for Annual Meeting



Cathedral of Learning

ALL signs point to a most successful meeting in Pittsburgh, January 23-26, when members of the Society gather for the 45th Annual Meeting. Pres. John F. Collins, Jr. of Pittsburgh Chapter has announced the personnel of the Committee on Arrangements as follows:

R. A. Miller, *General Chairman*
Arthur McGonagle, *Honorary Chairman*
C. M. Humphreys, *1st Vice-Chairman*
F. C. McIntosh, *2nd Vice-Chairman*
M. L. Carr, *Chairman, Finance Committee*
T. F. Rockwell, *Chairman, Publicity Committee*
D. W. Loucks, *Chairman, Transportation Committee*
R. J. J. Tennant, *Chairman, Inspection Committee*
P. A. Edwards, *Chairman, Technical Sessions*
A. F. Nass, *Chairman, Attendance Committee*
Mrs. J. F. Collins, Jr., *Ladies Committee*
R. B. Stanger, *Chairman, Entertainment Committee*
E. C. Smyers, *Chairman, Banquet Committee*
Percy Nicholls, *Chairman, Reception Committee*

Meeting headquarters will be at the William Penn Hotel. Room rates are from $3 to $6 single and $5 to $10 for double and twin-bed rooms.

A meeting of the Council will be held in advance of the general sessions and the official delegates of local Chapters will hold their annual conference to discuss problems of mutual interest.

A fine technical program has been prepared and the tentative schedule of events is as follows:

PROGRAM

Monday, January 23, 1939

Registration
Committee Meetings
Meeting of Chapter Delegates

Afternoon Session

Call to order by Pres. E. Holt Gurney
Greetings
Response by President Gurney
Reports of Council Committees
Report of Treasurer
Report of Committee on Research by W. L. Fleisher
Frictional Resistance to the Flow of Air in Ducts, by F. C. Houghten, J. B. Schmieler, John Zalovcik and Nicholas Ivanovic
Air Conditioning in Industry, by W. L. Fleisher, A. E. Stacey, Jr., F. C. Houghten and M. B. Ferderber
Report of Tellers of Election

Tuesday, January 24, 1939

Physiological Sensations Session

Recent Advances in Physiological Knowledge and Their Bearing on Ventilating Practice, by C.-E. A. Winslow.
Cardiac Output, Peripheral Blood Flow, and Blood Volume Changes in Normal Individuals Subjected to Varying Environmental Temperatures, by F. K. Hick, R. W. Keeton, Nathaniel Glickman and H. C. Wall.
The Role of the Extremities in the Dissipation of Heat from the Body in Various Atmospheric and Physiological Conditions, by Charles Sheard, Marvin M. D. Williams, Grade M. Roth and Bayard T. Horton.
Skin Temperatures of the Extremities and Effective Temperature, by Charles Sheard, Marvin M. D. Williams, and Bayard T. Horton.
Air Conditioning Requirements of an Operating Room, by F. C. Houghten and Dr. Lee Cook.

Heat Transfer Session

Some Reflection and Radiant Characteristics of Aluminum, by C. S. Taylor and J. D. Edwards.
A Study of the Heat Requirements of a Single Glazed Test House and a Double Glazed Test House, by M. L. Carr, R. A. Miller, Leighton Orr and David Shore.
Heat Transfer in Storage Water Heaters, by D. W. Nelson and A. A. Rosenberg.
Condensation of Moisture and Its Relation to Building Construction and Operation, by F. B. Rowley, A. B. Algren and C. E. Lund.

Past Presidents' Dinner.

Wednesday, January 25, 1939

Fuels Session

Responsibility of A.S.H.V.E. Towards Solid Fuel Industry, by W. A. Danielson.
Selection of Solid Fuels from the Viewpoint of the Small Consumer, by P. Nicholls.
Small Stokers, by P. A. Mulcey and R. A. Sherman.
Improvements That Are Needed in Heating Equipment, by T. H. Urdahl.
Performance of Stoker-fired and Hand-Fired Warm-Air Furnaces in the Research Residence, by A. P. Kratz, S. Konzo and R. B. Engdahl.

Luncheon Meeting Nominating Committee.

Air Pollution Session

Report of Guide Publication Committee.
Report of Educational Publicity Committee.
Limitations of Smoke Abatement Problems and Practical Methods for Their Elimination, by H. B. Meller.
Relation of Rank of Coal to Smoke Producing Tendencies, by H. J. Rose and F. P. Lasseter.
Air Filter Performance as Affected by Low Rate of Feed, Various Types of Carbon, Dust Particles Size and Density, by F. B. Rowley and R. C. Jordan.

Annual Banquet and Dance.

Thursday, January 26, 1939

Morning Session

Installation of New Officers.
The Effect of Heat Storage and the Variation in Outdoor Temperature and Solar Intensity on the Heat Transfer Through Walls, by J. S. Alford, J. E. Ryan and F. O. Urban.
The Determination and Practical Application of Weather Design Data by T. H. Urdahl, John Everetts, Jr., and J. C. Albright.
The Flow of Heat Through Walls, by F. E. Giesecke.
Reactions of Office Workers to Air Conditioning in South Texas, by A. J. Rummel, F. E. Giesecke, W. H. Badgett, and A. T. Moses.
Unfinished Business
New Business
Resolutions
Adjournment

Pittsburgh offers much to the visiting members and its central location makes it easily accessible. The city is noted for its educational institutions, which include Carnegie Institute of Technology, University of Pittsburgh, and Duquesne University, and it is a great manufacturing center, particularly of iron and steel products.

Attention will be focused on the work of the Society's Research Laboratory during this 45th Annual Meeting, as this occasion marks the celebration of the Laboratory's 20th year. The Laboratory, located at the U. S. Bureau of Mines, will be visited by many members who are interested in its Research projects.

Members should plan now to attend the Pittsburgh meeting, January 23-26.

Prof. Rowley to Receive F. Paul Anderson Medal

The Council of the Society has confirmed the nomination of Frank B. Rowley, Professor of Mechanical Engineering and Director of the Engineering Experiment Station at the University of Minnesota, to receive the F. Paul Anderson Medal, according to the official announcement of Pres. E. Holt Gurney. The medal is to be presented January 25, 1939, at the 45th Annual Meeting of the Society in Pittsburgh, and it will be awarded in recognition of Prof. Rowley's work performed in the field of heating, ventilation and air conditioning.

Professor Rowley will be the third engineer to receive this award for distinguished scientific achievement, the former recipients being Willis H. Carrier (1932) and Dr. Arthur C. Willard (1934).

Professor Rowley is honored for his work as a teacher of the art of heating and ventilation, for his research in the field of heat transmission and for his fundamental investigation of the resistances of air space and the effects of moisture and condensation on insulating materials.

Born in Evansville, Wis. 1888, Professor Rowley graduated from the University of Wisconsin with a degree of B. S. in 1905, and received his M. E. degree in 1906 from the same institution.

He started his engineering career with the Racine Gas and Light Co. and since 1907 has been on the staff of the University of Minnesota.

He joined the Society in 1918, served as its President in 1932; as a member of the Council from 1927 to 1933, as Chairman of the Committee on Research in 1929, Chairman of the Publication Committee in 1927, also as President of the Minnesota Chapter in 1922. Since 1919 he has served on innumerable technical committees and was instrumental in producing the Society's standards on testing of air cleaning devices and the code for determining heat transmission through building walls. He is the author of many papers in the Society's Transactions and has contributed many scientific articles to engineering publications.

He is a member of several scientific organizations which include the American Association for the Advancement of Science; Society for the Promotion of Engineering Education; American Society of Mechanical Engineers and the Minnesota Federation of Architecture and Engineering Societies.

Prof. Rowley's host of friends in the A. S. H. V. E. will be pleased to learn of the honor that has been conferred in recognition of his achievements and service.

Atlanta Meeting Discusses Research

November 1, 1938. The regular meeting of Atlanta Chapter was called to order by Pres. C. L. Templin, who dispensed with routine business and introduced the guest of honor, W. L. Fleisher.

Mr. Fleisher's talk, Research Finds Comfort and Efficiency for Industrial Workers, was enthusiastically heard by 18 members and 41 visitors. Invitations had been issued to all members of other engineering societies in the city, as well as contractors and architects. The close attention paid by the audience to the facts brought out by the speaker was indicated by the 40 minutes of questioning to which Mr. Fleisher was kind enough to reply. According to Secretary Tucker it was quite evident from this discussion that a world-wide interest in the subject would ultimately lead to a challenge to both labor and capital. Mr. Fleisher indicated that certain minimum conditions were necessary for the health of labor. These conditions, if maintained, would prove to be to the benefit of capital by increasing efficiency and production of workers.

Secretary Tucker was instructed to extend hearty thanks of the Atlanta Chapter to the A. S. H. V. E. Speakers Bureau, and to Mr. Fleisher for his excellent talk.

Mr. Fleisher, who arrived in Atlanta on Monday night, was met at the airport and escorted to his hotel by President Templin, Secretary T. T. Tucker, and L. L. Hamilton, chairman of the Program Committee. On Tuesday a luncheon was given for Mr. Fleisher by the Board of Governors at the Atlanta Athletic Club. Prior to the regular Chapter meeting, a dinner was given at the Biltmore Hotel.

Code Discussion by Ontario Chapter

November 7, 1938. Fifty-two members of Ontario Chapter held a meeting in the Royal York Hotel, which was preceded by dinner at 6:30 p.m. The minutes of the previous meeting were accepted as written by Secy. H. R. Roth.

Pres. H. B. Jenney turned the meeting over to H. H. Angus, chairman of the Code Committee. Mr. Angus called upon W. R. Blackhall, chairman of the Committee for the Code for the Design and Installation of Steam and Hot Water Heating Systems for Residences having up to 50,000 cu ft of volume, and Mr. Blackhall submitted the committee's proposed code. Several changes in the proposed code were announced by M. W. Shears, secretary of the Code Committee. A discussion followed and Mr. Shears recorded certain suggested changes which will be incorporated in the code by the committee.

It was moved by Mr. Angus and seconded by J. W. O'Neill that the Ontario Chapter adopt the code as presented with the various changes recommended, and the Chapter voted adoption of this motion.

October 3, 1938. Ontario Chapter held a regular meeting, preceded by dinner, in the Royal York Hotel, Toronto, with 56 members and guests present. Secy. H. R. Roth reported the committees for the coming year, which were selected by the Board of Governors and published in the annual report of the Chapter in the October Journal Section.

It was announced by C. Tasker that the meeting on November 7 was restricted to members, to discuss the proposed code for steam and hot water heating of buildings up to 30,000 cu ft capacity.

E. Holt Gurney, president of the A.S.H.V.E., introduced the principal speaker of the evening, J. F. McIntire, Detroit, 1st vice-president of the Society, who was a guest of the Ontario Chapter. Mr. McIntire spoke on The Engineer and the appreciation of the Chapter for his splendid address was expressed by Thomas McDonald.

E. R. Gauley presented Mr. McDonald with a certificate expressing the appreciation and high esteem of the Chapter for his services as a member and past president. It was announced that Mr. McDonald was leaving the Ontario Chapter because of changing his residence to Minneapolis, Minn.

J. F. McIntire Reviews A. S. H. V. E. Activities at Cleveland

October 10, 1938. Northern Ohio Chapter members met at the Cleveland Club with 27 present at dinner and 41 in attendance at the business session. Pres. J. P. Jones opened the meeting and the minutes of the May and October meetings were read by Secy. C. M. H. Kaercher and approved.

With Vice-Pres. D. L. Taze presiding, short verbal reports were heard from the standing committees on Membership, Standards, Publication and Legislative.

The Membership Committee presented applications from Tinkham Veale and J. C. Murphy, which the Chapter voted to accept.

Philip Cohen moved that the Chapter buy a gavel for the use of the presiding officer, but withdrew the motion upon offer of Paul Gayman to present one to the Chapter. It was then moved and carried that thanks be extended to Mr. Gayman for his generous offer.

The meeting was turned over to the Program Committee, who introduced the speaker of the evening, J. F. McIntire, Detroit, 1st Vice-President of the A. S. H. V. E. Mr. McIntire gave a glimpse behind the scenes of activities of the Society and outlined the work to be done in anticipation of the A. S. H. V. E. Annual Meeting and the Exposition in January 1940.

September 23, 1938. After an enjoyable afternoon of golf at the Aurora Country Club, and a dinner with 21 members present, Vice-Pres. D. L. Taze called a short business meeting.

Announcement was made of appointments to the standing committees as published in the annual report of the Chapter, and of L. T. Avery as chairman of the Committee on Arrangements for the Society's Annual Meeting in January 1940.

Applications for membership in the Chapter were presented by the Membership Committee. Upon motion of H. E. Wetzell the members voted to accept the following applicants as members of the Chapter: P. C. Hungerford, C. J. Glanzer, T. O. Murphy, A. P. Scholl and W. R. Moore.

There being no other business, Mr. Taze turned the meeting over to the Entertainment Committee for the balance of the evening.

Henry Kleinkauf

Iowa-Nebraska Enjoys Talk by F. B. Rowley

October 11, 1938. The opening meeting of the Iowa-Nebraska Chapter of the A. S. H. V. E. was held at the Savery Hotel, Des Moines, and was called to order by Pres. W. R. White following dinner. Thirty-six members and guests were present.

President White gave a resumé of last year's activities and stated the objectives of the current season. He mentioned that eight meetings had been held and that at the close of the year there were 40 members in the Chapter of a total of 70 Society members in Iowa and Nebraska. He suggested the desirability of increasing membership, attendance and activities by means of better publicized meetings, interesting programs, and an equal division of Chapter work.

President White explained the resignation of Secy. R. Hendrickson and the resultant election by the Board of Governors of Henry Kleinkauf as secretary.

Upon motion, business reports were postponed until the November meeting and the following three standing committees were appointed by President White:

Membership Committee—H. W. Stanton, M. B. Peiser, A. H. Ha, J. C. Knox, N. B. Delavan.

Meetings Committee—T. R. Johnson, F. L. D. Banner, W. V. Hagan.

Finance Committee—A. L. Walters, E. H. Borg, B. C. Waddington, W. V. Hagan, W. J. Hennessy.

It had been suggested by E. R. Morris, president of the Omaha Engineers Club, that two members of the Omaha group of the Iowa-Nebraska Chapter be appointed to act as members of the Board of Governors of the Engineers Club. Upon motion of Mr. Walters, seconded by Mr. Peiser, it was voted that President White and Secretary Kleinkauf be appointed to act on this Board.

Membership dues in the Society for the different grades of membership were explained in detail.

After a short recess, Mr. Delavan made some appropriate comments and presented the speaker of the evening, Prof. F. B. Rowley, University of Minnesota, a past president of the A. S. H. V. E. Professor Rowley gave an illustrated lecture on Condensation Within Walls and explained the results of laboratory experiments clearly and in a very interesting manner. At the close of his address he answered a number of questions which were brought to his attention before the meeting adjourned at 9:45 p.m.

Philadelphia Chapter Is Host to Pres. Gurney

October 13, 1938. A special dinner was arranged by the Meetings Committee and served in the auditorium of the Engineers Club preceding the regular meeting of the Philadelphia Chapter. Sixty-nine members and guests were present at dinner.

Pres. H. H. Erickson called the meeting to order and gave an opportunity to C. M. Hamilton to speak in behalf of the American Red Cross and its enrollment campaign.

Minutes of the previous meeting and the report of the treasurer were read and approved.

Edwin Elliot, chairman of the Membership Committee, stated that two new members, A. C. Jakoby and F. J. Wilson, had been elected to Chapter membership.

The chairman of the Meetings Committee, R. F. Hunger, announced the program for the November meeting and said that the speaker scheduled was G. L. Wiggs, whose subject was Modern Hot Water Heating Practice.

P. L. Pryibil, chairman of the Year Book Committee, reported that 85 per cent of last year's advertisers had already taken space in the new year book.

Announcement was made by L. P. Hynes, chairman of the Professional Division, *A. S. M. E.*, of a meeting to be held at the Bellevue-Stratford Hotel, November 9, by the Industrial Mobilization Board. Mr. Hynes stressed the importance of this meeting and requested that members of the Chapter attend if possible.

A motion was made by W. A. Bornemann that the Nominating Committee consist of L. P. ~~Hynes, chairman~~; W. F. Smith, L. C. Davidson, E. K. Wagner, and H. B. Hedges. It was duly moved that the nominations be closed and Secy. H. H. Mather was then instructed to cast the ballot for the nominees.

J. J. Nesbitt was the recipient of a Life Membership Certificate presented by Pres. E. Holt Gurney, Toronto, Canada.

A guest of honor at this meeting was T. Harold Fox, British Vice Consul of Great Britain, who was introduced by President Erickson.

Mr. Gurney, president of the A. S. H. V. E., was the guest speaker and was presented by M. F. Blankin. President Gurney gave an excellent talk on the work of the Society and the human problems that have arisen in connection with air conditioning. Mr. Gurney's talk was followed by an interesting and constructive discussion before the meeting was adjourned at 9:30 p.m.

Pres. Gurney Visits Washington, D. C. Chapter

October 12, 1938. Washington, D. C. Chapter held its first regular meeting at the Dodge Hotel with an attendance of 29 at dinner, and 41 at the business session.

Pres. S. P. Eagleton announced that N. S. Thompson had been made a Life Member of the society, but could not be present to receive his Life Membership Certificate, as he had been called out of town.

The Committees appointed for 1938-39 as presented in the annual report were announced by President Eagleton.

Secy. E. V. Fineran announced that the *A. S. M. E.* would resume activities with a meeting scheduled for October 13.

It was suggested by Secretary Fineran that those who cared to might find a worthy use for their 1937 GUIDES by turning them over to students in the air conditioning class at the Abbott Vocational Night School.

E. Holt Gurney, Toronto, Canada, president of the A. S. H. V. E., was introduced and spoke on Air Conditioning Brings Human Problems to the Engineer.

A very interesting discussion followed Mr. Gurney's inspiring talk and, at the suggestion of R. H. Feltwell, a rising vote of thanks was given to Mr. Gurney before the meeting was adjourned.

Cincinnati

Secy. R. E. Kramig, Jr. has prepared the following annual report of the Cincinnati Chapter, which numbers 49 on its membership roll.

The Officers and Board of Governors in charge for 1938-39 are:

President—O. W. Motz.

Vice-President—H. E. Sproull.

Secretary-Treasurer—R. E. Kramig, Jr.

Board of Governors—O. W. Motz, I. B. Helburn, H. E. Sproull, W. H. Junker, and R. E. Kramig, Jr.

A synopsis of meetings is included.

October 12, 1937. A dinner and meeting were held in the Gibson Hotel and the session was devoted to a thorough discussion of the possibility of being host to the A. S. H. V. E. at the Society's Annual Meeting in 1939. J. F. Turner, manager of Convention Bureau, Cincinnati Chamber of Commerce, supplied the Chapter with some valuable information.

November 9, 1937. The meeting was held at the Engineers Club with 35 members and guests in attendance. Perry West, head of the Mechanical Engineering School, University of Kentucky, addressed the Chapter on the Design and Operating Features of a Central Heating Plant. Mr. West described in detail the steam generating plant and central steam heating system at the University of Kentucky.

December 7, 1937. This was an inspection trip through the Airtemp, Inc. plant in Dayton, Ohio, followed by a dinner meeting and open forum held in the Engineers Club, Dayton.

January 11, 1938. Dinner was held in the Gibson Hotel followed by a business meeting at the Engineers Club. The speaker of the evening was Herman Seid, patent and engineering counsel, Auditorium Conditioning Corp., New York, who gave an interesting address on Air Conditioning Profits and Air Conditioning Standards.

February 8, 1938. The Chapter was the guest of the American Rolling Mill Co. at Middletown, Ohio and enjoyed an inspection trip through the plant, arranged by Tom Byrd. Dinner was served in the Manchester Hotel and 40 members from Cincinnati, Middletown, Dayton and vicinity were in attendance. Following dinner, the meeting was addressed by Dr. Anson Hayes, director of research, American Rolling Mill Co. on Research Activities in the Steel Industry. After the address, the members adjourned to the new research building and inspected the heating, air conditioning and laboratory equipment.

March 8, 1938. The meeting started with dinner in Old Vienna and adjourned to the Engineers Club. H. B. Bainbridge, Johns-Manville Co., presented a talking picture entitled Heat and Its Control.

April 6, 1938. Dinner was served at the Old Vienna Restaurant and the meeting adjourned to the Engineers Club. F. R. Bichowsky, Dow Chemical Co., Midland, Mich., addressed the Chapter on the subject of Comfort and Industrial Air Conditioning with Lithium Chloride. The open forum after the meeting for questions and answers proved that the audience had been keenly interested and attentive.

May 11, 1938. This meeting was given over to fun and frolic at the Hartwell Country Club, Hartwell, Ohio and although golf games were affected by rain, many other forms of amusement were observed. Following dinner, Tom Byrd, Middletown, showed a talking picture entitled The Romance of Iron and Steel. At this meeting the election of officers was held and annual reports were rendered.

The Chapter enjoyed a very instructive and successful season during 1937-38 under the leadership of the following Officers and Committees:

President—I. B. Helburn.

Vice-President—O. W. Motz.

Secretary—H. E. Sproull.

Board of Governors—I. B. Helburn, chairman; C. E. Hust, O. W. Motz, E. B. Royer, and H. E. Sproull.

Membership Committee—O. W. Motz, chairman; A. W. Edwards, G. B. Houliston, R. E. Kramig, Jr., and H. A. Pillen.

Finance Committee—H. E. Sproull, chairman; J. J. Braun, E. J. Richard, R. W. Sigmund, and Anker Winther.

Meetings Committee—C. E. Hust, chairman; W. H. Junker, W. C. Pistler, W. R. Stevens, and K. A. Wright.

S. P. Eagleton

E. V. Fineran

Washington, D. C.

The annual report of Washington, D. C. Chapter has been prepared by Secy. E. V. Fineran who reports that there are 78 members on the Chapter rolls.

Officers and Committees for the season of 1938-39 are:

President—S. P. Eagleton.

Vice-President—S. L. Gregg.

Secretary—E. V. Fineran.

Treasurer—W. R. Lockhart.

Board of Governors—L. S. Ourusoff, Glegge Thomas, and T. H. Urdahl.

Program Committee—F. E. Spurney, chairman; R. R. Cover, and S. L. Gregg.

Meetings Committee—A. E. Stack, chairman, and P. H. Loughran, Jr.

Publicity Committee—T. H. Urdahl, chairman; S. L. Gregg, and L. S. Ourusoff.

Membership Committee—E. H. Lloyd, chairman; A. C. Crawford, and P. H. Erisman, Jr.

Auditing Committee—W. E. Kingswell, chairman, and R. H. Feltwell.

The annual report includes a synopsis of meetings held during the past year.

October 13, 1937. The Chapter's interest and activity in connection with a proposed Refrigeration Code for Washington, D. C., was explained. It was announced that there were ten new candidates for membership. C. W. Walton, Jr., New York, gave a vivid description of air conditioning systems at Rockefeller Center. Attendance—37 members and guests.

November 10, 1937. Prof. C. P. Yaglou, Harvard University, spoke on Air Conditioning and Its Effect on Health, Comfort and Disease. Attendance—55 members and guests.

December 8, 1937. It was announced that the D. C. Health Department had selected a committee to suggest Standards for Air Conditions in Public Places and Places of Commercial Occupancy. F. E. Spurney talked on Mechanical Construction and Installation Problems in Modern Building. Attendance—50 members and guests.

January 12, 1938. The Membership Committee announced the addition of 18 members. The speaker of the evening was H. K. Kugel, Smoke Inspector for the District of Columbia. Attendance—48 members and guests.

February 2, 1938. William Goodman spoke on Dehumidification of Air with Coils. Attendance—60 members and guests.

March 9, 1938. This meeting was a joint session with the *American Society of Mechanical Engineers.* The meeting was addressed by V. A. Schlenken, consulting engineer, New York, whose subject was Noise, Sounds and Vibrations in Ventilating Ducts. Attendance—50 members and guests.

April 13, 1938. After nomination of officers, John Meyers, Johnson Service Co., spoke on Pneumatic Temperature Control Systems. Attendance—35 members and guests.

May 12, 1938. This meeting was held in the Federal Reserve Board Building. After dinner, there was a tour of the building. T. H. Urdahl told of the work of the District of Columbia Engineering Council. President Ourusoff reviewed the year's activities and reported an increase in membership from 40 at the beginning of the year to 70 at the end of the year, with 28 good prospects. Officers were elected for the season of 1938-39.

C. S. Leopold, consulting engineer, Philadelphia, spoke on Air Conditioning Systems in General. Attendance—60 members and guests.

Iowa-Nebraska

Iowa-Nebraska members started their second year with a meeting on October 11 when Prof. F. B. Rowley spoke to them through the Society's Speakers Bureau. The officers in charge, who were elected at the May meeting are:

President—W. R. White
Vice-President—T. R. Johnson
Secretary—R. L. Hendrickson (May to October 1938);
Henry Kleinkauf (From October 1938)
Treasurer—Perry LaRue
Board of Governors—A. L. Walters, H. W. Stanton, R. A. Norman.

Meetings were held regularly during 1937-1938 and are summarized in the annual report presented by President White.

September 22, 1937. Organization meeting and dinner at Hotel Fontenelle, Omaha, initiated by M. J. Stevenson. A talk was given by A. V. Hutchinson, secretary of the Society on the procedure to be followed in the formation of an A.S.H.V.E. Chapter. Attendance—54.

October 12, 1937. Dinner at Hotel Fort Des Moines, Des Moines. Speaker: Prof. F. E. Giesecke, College Station, Tex. Subject: The A.S.H.V.E.—Its History, Purpose, Activities, and Accomplishments. Attendance—63 members and 15 guests.

November 19, 1937. Dinner at Fontenelle Hotel, Omaha. Speaker: D. S. Boyden, Boston, Mass., president of the A.S.H.V.E. Subject: Economic Use of Steam. Attendance—43 members and 6 guests.

December 14, 1937. Dinner at Hotel Kirkwood, Des Moines, Iowa. Business meeting during which action was taken on the adoption of rules and by-laws, the selection of A. L. Walters as delegate to the Society's Annual Meeting, and the election of the Board of Governors. Attendance—19.

January 11, 1938. Meeting at Hotel Rome, Omaha. Speaker: John Howatt, Chicago, Ill. Subject: A Few Air Conditioning Problems and Answers. Attendance—35.

February 8, 1938. Meeting at Hotel Kirkwood, Des Moines. At the business session members were selected for the Nominating Committee, Meetings Committee, and Publicity Committee. Speaker: Dr. E. V. Hill, Chicago, Ill. Subject: The Effect of Air Conditioning on Comfort, Health and Disease. Attendance—28.

March 8, 1938. Meeting at Hotel Cornhusker, Lincoln. Speaker—R. F. Rosenbach. Subject: Air Conditioning Installation in the Union Pacific Headquarters Building. Attendance—53.

April 8, 1938. Meeting held in conjunction with the Heating, Ventilating and Air Conditioning Conference at Iowa State College, Ames. Evening session at Sheldon Munn Hotel. Speaker: Herman Seid, New York, N. Y. Subject: Air Conditioning Patents and Their Effect on the Industry's Development.

May 10, 1938. Annual meeting at Omaha Field Club, Omaha. Golf tournament, dinner, entertainment, election and installation of officers.

During the past year the following officers and committees served the Chapter:

President—M. J. Stevenson (October 1937 to January 1938);
A. L. Walters (January to May 1938)
Vice-President—A. L. Walters (October 1937 to January 1938)
Secretary—W. R. White
Treasurer—F. L. D. Banner
Board of Governors—R. A. Norman, J. C. Knox, W. V. Hagan, and the Officers.
By-Laws Committee—W. R. White, chairman; A. L. Walters, H. A. Sallander.
Membership Committee—Henry Kleinkauf, chairman; E. L. Millard, W. V. Hagan, F. E. Prawl.
Nominating Committee—R. A. Norman, chairman; Perry LaRue, L. K. Lycan, M. S. Tapley, W. R. White.
Meetings Committee—N. B. Delavan, F. E. Triggs, F. L. D. Banner, H. A. Sallander.
Publicity Committee—C. V. McReynolds, W. J. Hennessey, A. H. Raven, M. L. Todd, W. R. White.

St. Louis

St. Louis Chapter activities are under the leadership of the following officers and committees, who will serve during 1938-1939:

President—E. E. Carlson.
First Vice-President—R. J. Tenkonohy.
Second Vice-President—C. E. Hartwein.
Secretary—D. J. Fagin.
Treasurer—M. F. Carlock.
Board of Governors—G. W. F. Myers, L. R. Szombathy, C. F. Boester, F. C. Laufketter.
Program Committee—R. J. Tenkonohy, chairman; J. H. Carter, C. F. Boester, F. C. Laufketter.
Membership Committee—L. R. Szombathy, chairman; E. H. Ronsick, J. J. Dubois, C. R. Davis.
Entertainment Committee—W. N. O'Brien, chairman; J. S. Rosebrough, J. S. Malone.
Educational Committee—G. B. Rodenheiser, chairman; L. W. Moore, E. A. White.
Publicity Committee—C. E. Hartwein, chairman; W. J. Oonk, J. F. Hamilton.
Auditing Committee—J. W. Cooper, chairman; L. B. Scherrer, J. M. Foster.
Associated Engineering Societies—E. E. Carlson, representative; Paul Sodemann, alternate; J. D. Falvey and G. W. F. Myers, counsellors.

Meetings were held regularly and a resumé is included in the annual report prepared by Secretary Fagin.

September 14, 1937. Subject: A Story in Steel, presented by F. G. White, Granite City Steel Co., Granite City, Ill. Attendance: 20 members and 14 guests.

October 6, 1937. Subject: Heating and Air Conditioning a Windowless Building, by R. E. Hattis, consulting engineer, Chicago, Ill. Attendance: 23 members and 22 guests.

November 2, 1937. Subject: Smoke Abatement, presented by R. R. Tucker, Commissioner of Smoke Abatement for the City of St. Louis. Attendance: 16 members and 20 guests.

December 7, 1937. Subject: Heating and Air Conditioning the New Southwest High School, by J. L. Carlisle, chief engineer, Board of Education, City of St. Louis. Attendance: 20 members and 15 guests.

January 4, 1938. Subject: Physiologic and Health Factors as Related to Air Conditioning, by Dr. C. A. Mills, professor of experimental medicine, University of Cincinnati. Attendance: 20 members and 19 guests.

January 27, 1938. Joint meeting with local members of the *A. I. A.* and the Engineers Club of St. Louis. Subject: Air Conditioning Problems (100 tons to 1200 tons), by C. S. Leopold, consulting engineer, Philadelphia, Pa. Attendance: 220 present.

February 28, 1938. Subject: Air Conditioning Brings Human Problems to the Engineer, by E. H. Gurney, Toronto, Ont., president of the A. S. H. V. E. Attendance: 18 members and 19 guests.

April 5, 1938. Meeting at the David Ranken Jr. School of Mechanical Trades. Subject: Application of Activated Alumina for the Elimination of Moisture, by G. L. Simpson, vice-president and general manager, Pittsburgh Lectrodryer Corp., Pittsburgh, Pa. Attendance: 30 members and 51 guests, with 250 present to hear the guest speaker.

May 3, 1938. Subject: This evening was designated as L. Walter Moon night. Mr. Moon, charter member of the St. Louis Chapter, spoke on the early pioneer days of the Chapter. This was followed by a motion picture entitled, Heat and Its Control, presented by R. W. Hoffman and W. A. Wallace, Johns Manville Corp. Attendance: 25 members and 18 guests.

June 15, 1938. Dinner dance at the Norwood Country Club. Attendance: 104 members and guests.

British Heating, Ventilation and Air Conditioning Exhibition

Announcement has been made by V. A. Kraminsky, director, that a Heating, Ventilation and Air Conditioning Exhibition will be held during the week of September 28, 1939, at Horticultural Hall, London.

This Exhibition for the advancement of the science of heating, ventilation and air conditioning engineering will be the first of its kind in England and American engineers visiting that country are invited to attend.

New Consulting Offices Opened

Charles E. Mayette announces the establishment of a consulting engineering office at 1417 Graybar Building, New York City. Mr. Mayette was formerly principal mechanical engineer of the U. S. Housing Authority and as a consultant he will specialize in designing mechanical equipment for large scale housing operations.

Bayard P. Fonda has announced the opening of offices for consulting work in air conditioning, mechanical and electrical engineering. New offices are located at 513 North Charles St., Baltimore, Md.

CANDIDATES FOR MEMBERSHIP

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society or sent to the members in other approved manner as ordered by the Council. When replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 31 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge the members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by December 15, 1938, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

CANDIDATES	REFERENCES	
	Proposers	*Seconders*
BERRIDGE, W. W., Sales Engr., McColl-Frontenac Oil Co., Ltd., Montreal, Que., Can.	H. R. Hughes G. L. Wiggs	W. U. Hughes F. A. Hamlet
BUSSE, HERBERT, Chief Engr., Fisher & Co., Detroit, Mich.	S. S. Sanford G. D. Winans	G. H. Tuttle H. E. Ziel (*Non-Member*)
CAMPBELL, A. O., Engr., Okla. Gas & Elec. Co., Oklahoma City, Okla.	E. W. Gray S. L. Rolland	L. H. Schoenhofen J. H. Carnahan
CLARK, A. N., Engr., Good Housekeeping Inst., New York, N. Y.	G. W. Alder (*Non-Member*) E. E. Wilson (*Non-Member*)	P. W. Punnett (*A. S. C.*) W. H. Eady (*Non-Member*)
CROPPER, R. O., Operating Engr., War Dept., Ft. Knox, Ky.	W. A. Danielson L. S. O'Bannon	Perry West J. W. May
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Yates, R. A., Steamfitter, Yates Neale & Co., Brandon, Man., Can.	J. E. Yates J. E. Yates, Jr.	D. F. Michie R. P. Hinton
Zimmerman, A. H., Ventilation Engr., Chicago Board of Health, Chicago, Ill. (*Advancement*)	J. J. Aeberly E. V. Hill	O. W. Armspach John Howatt

CANDIDATES ELECTED

In the past issues of the Journal of the Society the names of the following men were listed as Candidates for Membership. The membership grade of each Candidate has been assigned by the Committee on Admission and Advancement and balloted upon by the Council. We are now instructed by the Council to post herewith, as required by Art. B-III, Sec. 8, of the By-Laws, the following list of candidates elected:

MEMBERS

Cullin, W. W., Chief Engr., Home Insulation Div., Johns-Manville Sales Corp., New York, N. Y.

Cushing, C. F., Mgr., Air Cond. Sales, Bryant Heater Co., Cleveland, Ohio.

Foley, J. L., Mgr., Wholesale Dept., Avery Engrg. Co., Cleveland, Ohio.

Gross, J. A., Gen. Mgr., Wynne Constr. Service, Philadelphia, Pa.

Koch, A. H., Br. Mgr., Minneapolis-Honeywell Reg. Co., Atlanta, Ga.

Lenone, J. M., Design Engr., Wilson & Co., Chicago, Ill. (*Reinstatement*)

MacWatt, Donald, Sales Engr., Powers Regulator Co., New York, N. Y.

Nachman, G. P., Secy. & Treas., The Spohn Htg. & Vtg. Co., Cleveland, Ohio.

Troup, J. D., Managing Director, John D. Troup, Ltd., London, England.

ASSOCIATES

Hard, A. L., Chief Engr., Thomas Emery's Sons, Inc., Cincinnati, Ohio.

Kirkendall, H. J., Htg. Salesman, Shamblen Furnace Parts Co., Pittsburgh, Pa.

Light, J. C., Sales Engr., Boyd Engrg. Co., El Paso, Texas.

Masters, R. B., Inspector, Pacific Greyhound Lines, Pontiac, Mich.

Moore, F. C., Dist. Mgr., Aerofin Corp., Toronto, Ont., Can.

Parker, L. L., Partner, Gas Appliance Co., Washington, D. C.

JUNIORS

Gee, W. W., Design Engr., Cochran & St. John, San Francisco, Calif.

Kramer, Conrad, Engr., Edw. A. Lutz, Inc., Pawtucket, R. I.

Phillips, R. H., Engr., Carrier Corp., Los Angeles, Calif.

Veale, Tinkham, Sales Engr., Avery Engrg. Co., Cleveland, Ohio.

STUDENTS

Forbes, H. B., Jr., Student, Purdue Univ., West Lafayette, Ind.

Heating ◆ Piping and Air Conditioning

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January-December, 1938—Vol. 10, Nos. 1-12

As will be noted, these abstracts are classified under general heads. In looking for information on a specific subject, it will be well to look through the abstracts under the most suitable heading, and also to look through those under the other headings. For example, some of the heating articles also contain information on air conditioning, and vice versa, as the grouping has been made on the basis of the subject most prominently covered in the article.

The index to the Journal Section *of the* American Society of Heating and Ventilating Engineers *is separate (see page 826).*

This index does not include Equipment Developments; Book Reviews; Booklets, Reports, and Papers; Recent Trade Literature; Conventions and Expositions; Schools and Study Courses—departments appearing regularly each month. The Editor's Page in each issue includes items of news, comments on current events, etc. In the January, 1938, issue a complete directory section was published covering heating, piping and air conditioning equipment for industry and large buildings.

Air Conditioning

After College—Air Conditioning? by Herbert Raisler
Vol. 10, *No.* 6. *June,* 1938. *p.* 372
Opportunities for engineering graduates in air conditioning; scholastic preparation; obtaining employment; training in industry; opportunities.

Air Conditioned Tourist Camp—Drive In, by George M. Sebree
Vol. 10, *No.* 5. *May,* 1938. *p.* 301
Description of Sea Breeze Tourist Village, Phoenix, Ariz.; air conditioned by refrigerated water circulating system with connections to overhead finned coil and fan unit in each room; advantages of air conditioning a tourist village; 30 ton ammonia compressor cools water; cooling and heating calculations; building construction; why an evaporative cooling system was not used; gas fired boiler; heating domestic water; connections provided for future solar water heater; control; two sizes of room units; installing the underground water supply and return lines; cost of air conditioning system; schematic diagram showing valves and piping.

Air Conditioning and the Income Tax, by Lawrence R. Bloomenthal
Vol. 10, *No.* 9. *September,* 1938. *p.* 593
Estimating probable useful life of air conditioning equipment for working out depreciation for income tax purposes; methods of computing depreciation; deducting losses; depreciation rates for various items of equipment; service contracts; repair expense.

Air Conditioning a Production Factor
Vol. 10, *No.* 8. *August,* 1938. *p.* 532
Air conditioning the Warren Telechron Co. plant, Ashland, Mass.; brief description of system; heat load due to clock motors.

Air Conditioning Becomes Locally Competitive, by Knight C. Porter and William P. Rock
Vol. 10, *No.* 3. *March,* 1938. *p.* 172
Analysis of growth of commercial air conditioning in a neighborhood business center (63rd and Halsted Sts., Chicago); map of district showing air conditioned establishments; greatest air conditioning sales in 1938 will be local commercial competition.

Air Conditioning Design and Operation Demand Real Engineering Skill, by H. Warr
Vol. 10, *No.* 1. *January,* 1938. *p.* 16
Importance of air conditioning department stores; history of air conditioning for J. L. Hudson Co. store, Detroit, Mich.; first air conditioning in 1925; extensions since then; type of equipment and conditions maintained; effect of sun on cooling load; typical scheme of installing equipment; motors controlled from starting board; maintenance routine; load curve for sun gain only at various hours of day; load curve showing total of all factors; diagram showing position of sun in respect to building at various hours of day.

Air Conditioning for Human Comfort Discussed by Leading Authorities
Vol. 10, *No.* 12. *December,* 1938. *p.* 763
Report of Air Conditioning Symposium held in Chicago November 22; speakers were Dr. Irving S. Cutter, Charles S. Leopold, John R. Hertzler, Albert Buenger, Elliott Harrington, William B. Henderson, and Willis H. Carrier; importance of correct air conditioning; engineering aspects; standards; refrigeration for air conditioning; the architect's problem; costs; products available; the development of air conditioning.

Air Conditioning Overcomes Summer Slump in Bowling, by A. A. Maycock
Vol. 10, *No.* 11. *November,* 1938. *p.* 708
Advantages of air conditioning Ritz Bowling Palace, Salt Lake City, Utah; cooled by deep well water; consideration given to mechanical refrigeration; system is sectionalized; air distribution; control; method of heating.

Air Conditioning Review
Vol. 10, *No.* 1. *January,* 1938. *p.* 26
Table showing number of air conditioning installations and connected horsepower for air conditioning for commercial and residential buildings, industrial plants, and residences for 1936, 1937 and totals as of December 1, 1937 for various cities; number of ice-using air conditioning systems in five cities; connected horsepower for these jobs; number of air conditioned railroad cars and types of systems used for railroad car air conditioning; outlook for air conditioning during 1938; types of buildings estimated to be most responsive to air conditioning sales in 1938.

Air Conditioning Takes to the Highways
Vol. 10, *No.* 5. *May,* 1938. *p.* 314
Brief description and diagram of air conditioned bus of Santa Fe Trailways; description of air conditioned bus for Interstate Transit Lines; perforated false roof used for air circulation; units of the system; the refrigeration power assembly.

Air Conditions Discussed at Therapy Congress
Vol. 10, *No.* 10. *October,* 1938. *p.* 650
Report of annual convention and exhibit of American Congress of Physical Therapy; air conditioned "Climatorium" proposed; exhibit on weather changes and the onset of colds; paper on biologic effects of therapeutical fever.

Air Paths from Grilles, by A. L. Greenlaw and T. S. Hart
Vol. 10, *No.* 6. *June,* 1938. *p.* 387
Importance of eliminating drafts in air conditioning; various types of grilles tested; test method; throw of air stream from straight flow grilles; effect of size of grille, velocity and aspect ratio; formula for length of throw.

Air Paths from Grilles, by A. L. Greenlaw and T. S. Hart
Vol. 10, *No.* 7. *July,* 1938. *p.* 452
Effect of various face designs of grilles on air path; results of tests tabulated; illustrations of smoke tests of air flow from various types of grilles; vertical path of the air stream—effect of face velocity on drop of air stream, effect of aspect ratio of grille on drop, and effect of temperature differential on drop; summary of conclusions drawn from tests made by the authors.

Atmospheric Pollution in a City and What It Means to the Engineer, by A. D. Singh, Frank A. Chambers and I. A. Deutch
Vol. 10, *No.* 10. *October,* 1938. *p.* 647
Apparatus and method used for making air pollution survey of Chicago; city divided into various types of areas; amount of SO_2 in atmosphere in the various areas; map showing distribution of sulphur dioxide in atmosphere with various prevailing winds; tests made in air conditioned office building; effects of atmospheric pollution; corrosion of metal surfaces.

Building Conditioned for $1.00 per Square Foot
Vol. 10, *No.* 5. *May,* 1938. *p.* 305
Net cost of air conditioning John Mariner Building, Milwaukee, Wis., approximately $1.00 per sq ft; management attributes about 80 per cent of higher rental asked to added value offered by air conditioning; central station system with compressors in basement and air circulating equipment in penthouse.

Bus Air Conditioning, by Jerry Hicke
Vol. 10, *No.* 10. *October,* 1938. *p.* 639
Sample calculation for air conditioning load for a bus; conduction heat gain; heat transfer coefficients for glass areas, and walls and roof; calculation of solar heat gain; volume of air to circulate; method of air distribution; cooling load estimate sheet showing calculations; psychrometric chart illustrating air conditions.

Check Charts for Air Conditioning Calculations, by J. M. Dean
Vol. 10, *No.* 5. *May,* 1938. *p.* 321
First two of a series of forms and charts for quickly checking air conditioning computations; scope of the charts; accuracy; comfort cooling survey analysis chart; guide sheet.

Check Charts for Air Conditioning Calculations, by J. M. Dean
Vol. 10, *No.* 6. *June,* 1938. *p.* 389
Chart for width, length, height, area and volume; chart for determining heat transmission coefficients for walls; explanation of use.

Check Charts for Air Conditioning Calculations, by J. M. Dean
Vol. 10, *No.* 7. *July,* 1938. *p.* 457
Chart No. 3—wall transmission load chart; Chart No. 4—solar heat gain calculations.

Check Charts for Air Conditioning Calculations, by J. M. Dean
Vol. 10, *No.* 8. *August,* 1938. *p.* 519
Chart 5 for checking sensible and latent heat of occupants, heat load due to lights, fan motor and duct gains, and conversion scale for cfm and cfh; Chart 6 for determining cfm requirements.

Check Charts for Air Conditioning Calculations, by J. M. Dean
Vol. 10, *No.* 9. *September,* 1938. *p.* 585
Chart 7 for checking sensible and latent heat gains due to ventilation air, and grains of moisture per pound of air to be removed; Chart 8 for determining grains per pound of air entering conditioned space and other psychrometric conditions of this air.

Check Charts for Air Conditioning Calculations, by J. M. Dean
Vol. 10, *No.* 10. *October,* 1938. *p.* 645
Chart 9 for determining total pounds of air to be supplied; Chart 10 for checking the characteristics of air entering the fan.

Check Charts for Air Conditioning Calculations, by J. M. Dean
Vol. 10, *No.* 11. *November,* 1938. *p.* 713
Chart 11 for computing pounds per minute of ventilating air, recirculated air, and total air with cfm and cu ft per pound of ventilation air and recirculated air known; Chart 12 for determining conditions of mixtures of two quantities of air.

Check Charts for Air Conditioning Calculations, by J. M. Dean
Vol. 10, *No.* 12. *December,* 1938. *p.* 785
Chart No. 13 for determination of saturation temperature of air leaving coils; Chart No. 14 for determining proportions by weight of air through coils and bypassed.

Chemical Dehumidification of Air, by H. J. Kaufman
Vol. 10, *No.* 7. *July,* 1938. *p.* 440
Preventing condensation in electrical substations; use of chemical dehumidifying cabinet; amount of water removed from air and cost of chemical; drying effervescent salts; diagram of continuous salt drying apparatus.

City Air Searched for Sulphur Fumes
Vol. 10, *No.* 9. *September,* 1938. *p.* 569
Results of 15 months' survey to determine average amounts of sulphur gases in air announced by Air Hygiene Foundation and Mellon Institute; 50,000 separate air tests made; sulphur dioxide per million parts of air for St. Louis-E. St. Louis, Pittsburgh, Detroit, Philadelphia-Camden, and Washington; factors causing sulphur pollution; occasional tests made in 20 other cities.

Concrete Pipe Return Ducts
Vol. 10, *No.* 4. *April,* 1938. *p.* 249
Offices of Clapp Baby Food Co., Rochester, N. Y., air conditioned; precast concrete pipe used for underground return ducts; sizes, lengths and cost of pipe; joints.

Control of Air-Borne Organisms, by H. C. Murphy
Vol. 10, *No.* 4. *April,* 1938. *p.* 232
Size and characteristics of bacteria; recent studies on bacteria in air reviewed; germ carrying droplets studied at Harvard School of Public Health; dispersion of droplets and airborne organisms; air pollution survey of New York City; bacteria in air in various locations; method of taking samples; bacteriological survey of telephone booths showing advantages of filtered air; bacteria in air from humidifying water.

Control of Air-Borne Organisms, by H. C. Murphy
Vol. 10, *No.* 6. *June,* 1938. *p.* 384
Various industrial applications of air filters; effectiveness of bacteria filters in breweries; uses in the food industry; development of air cleaning devices; air pollution and health.

Cooled Operating Rooms Prove Boon to Doctors, by Lyman R. Flook
Vol. 10, *No.* 3. *March,* 1938. *p.* 182
Description of conversion of ventilating system to complete air conditioning for operating rooms at Billings hospital, University of Chicago; description of system and duct layout; refrigeration furnished by existing carbon dioxide refrigeration machines; chilled water for sprays supplied by brine tank; special fixture developed for supplying and exhausting air; details of fixture; operating results and costs; observed temperatures and humidities.

Cost of Refrigeration for Air Conditioning, by Lewis W. Mauger
Vol. 10, *No.* 7. *July,* 1938. *p.* 456
Air conditioning system for several floors of New York City office building; steam jet refrigeration originally installed; cooling tower supplemented by city water; limitations on condensing water when plant capacity was increased led to installation of "Freon" refrigeration; comparison of cost of operation for steam jet and "Freon" refrigeration; size and motor rating of principal equipment; temperatures and humidities maintained.

Criticism on Foundry Spray Booth Asked by Reader, by Samuel R. Lewis
Vol. 10, *No.* 1. *January,* 1938. *p.* 100
Reader requests criticism of scheme for using air exhausted from a foundry core-wash spraying booth for ventilating and cooling; spray nozzles instead of flood nozzles recommended; arrangement of nozzles; eliminators; air velocity; air distributing partitions.

Department Store Cuts Conditioning Cost by Careful Planning for Economy, by Walter A. Henne
Vol. 10, *No.* 8. *August,* 1938. *p.* 507
Air conditioning of the H. & S. Pogue Co. department store, Cincinnati; areas conditioned; method of conditioning beauty parlor booths; analyzing the heat loads; preliminary survey of existing plant; utilization of exhaust steam from electric generating equipment; steam turbine drive for centrifugal refrigeration compressor; cooling tower; ducts and outlets; pneumatic control; motor starters; saving by using exhaust steam turbines; saving by using cooling tower; operating the system; advantages of store air conditioning; diagram showing steam and water flow for the air conditioning plant.

Designers and Air Conditioners Confer
Vol. 10, *No.* 7. *July,* 1938. *p.* 461
Report of conference of professional interior designers, architects and air conditioning authorities; introductory remarks of Charles S. Leopold; entrance and exit shock; function of consulting engineer in air conditioning; health dividends from air conditioning; location of grilles from the air conditioning engineer's and the interior designer's viewpoints; need of cooperation.

Determining Relative Humidity at Low Temperatures, by E. Vernon Hill
Vol. 10, *No.* 1. *January,* 1938. *p.* 20
(Answer to reader's question); use of whirling psychrometer in determining relative humidity below 0 F; precautions in use; humidification at low temperatures.

Dome for World's Largest Telescope Presents Unusual Insulation Problem, by Channing Turner
Vol. 10, *No.* 6. *June,* 1938. *p.* 369
Description of Mt. Palomar astrophysical observatory and 200 in. telescope; cross section of dome building and telescope; use of air conditioning for grinding and polishing mirror; importance of preventing wide temperature variations; dome construction; method of insulating dome with aluminum foil; lower walls of structure double.

Electricity Used by Air Conditioning, by William P. Rock
Vol. 10, *No.* 1. *January,* 1938. *p.* 46
Data on power consumption of air conditioning systems given in summary sheet form; kilowatthours and kilowatt figures for general offices, doctors' and dentists' offices, restaurants, beauty parlors, theaters, funeral parlors, department stores, candy stores, drug stores, hotels and shoe stores, based on survey of monthly meter readings during 1936 for installations in Chicago; weather conditions during period of survey.

Eliminating Fire Hazards in Air Conditioning Work, by H. C. Murphy
Vol. 10, *No.* 9. *September,* 1938. *p.* 580
Amendments to regulations of National Fire Protection Association recently adopted; combustible coverings and insulation of ducts; provisions for cleaning ducts; fire dampers; location of air inlet and outlet openings; air filters; automatic extinguishing equipment; smoke detectors recommended.

Evaporative Condenser, by William Goodman
Vol. 10, *No.* 3. *March,* 1938. *p.* 165
(Part 1); description and schematic diagram of evaporative condenser; equilibrium temperature of spray water; how to compute total heat transferred; chart and tables for determining temperature of spray water; example of computation; rating of condensers; heat theoretically rejected to "Freon" condenser in Btu per minute per ton; selection of air quantity and coil area; graph showing cfm per ton vs. sq ft of external area per ton; example showing computation of required area and cfm per ton.

Evaporative Condenser, by William Goodman
Vol. 10, *No.* 4. *April,* 1938. *p.* 255
(Part 2); effect of change of coefficients on condenser capacity; air quantity per ton plotted against tons per 100 sq ft of external area for various coefficients of heat transfer; temperature of spray water plotted against air quantity; temperature of spray water and theoretical maximum capacity of condensers; final wet and dry bulb temperatures of leaving air; quantity of water evaporated; practical pointers on operation—increasing capacity, effect of noncondensable gases, and precautions with roof installations.

Evaporative Condenser, by William Goodman
Vol. 10, *No.* 5. *May,* 1938. *p.* 327
(Appendixes); derivation of equations given in text; proof that condition of air flowing through evaporative condenser can be represented by straight line on psychrometric chart.

E. Vernon Hill's Page—Saturated Air Above 212 F
Vol. 10, *No.* 3. *March,* 1938. *p.* 185
Definitions of relative humidity and saturated air; moisture in air at high temperatures; importance of proper use of the terms "saturated air" and "relative humidity."

E. Vernon Hill's Page—Vacuum
Vol. 10, *No.* 4. *April,* 1938. *p.* 254
Methods of obtaining vacuum in the laboratory; use of steam jet and multistage compressor for vacuum refrigeration in air conditioning; method of measuring vacuum confusing.

E. Vernon Hill's Personal Comments—Body Heat
Vol. 10, *No.* 1. *January,* 1938. *p.* 95
Importance of research on human comfort in relation to the air environment; body heat production; basal metabolism; surface area chart showing how square feet of surface of body varies with weight and height; table of metabolism for different animals; heat production per pound varies widely but is surprisingly constant when based on skin surface; amount of heat generated in body; conclusions on factors affecting comfort.

E. Vernon Hill's Personal Comments
Vol. 10, *No.* 2. *February,* 1938. *p.* 118
Discussion of saturated air above 212 F; relative humidity with air at high temperatures; term "relative humidity" cannot be used in temperatures above 212 F unless a new definition is adopted.

Figuring Solar Heat Gains of Buildings, by William Goodman
Vol. 10, *No.* 5. *May,* 1938. *p.* 315
(Part 1); solar heat gain substantial part of cooling load; radiant energy and heat; tables of solar heat gains through windows and skylights, and solar temperature differences for walls and roofs, for 0, 10, 20 and 30 deg latitude; method of using the tables for windows and skylights; equation for conduction heat gain through a window, wall or roof in the shade; values computed for double glass; effect of shades, venetian blinds and awnings on solar heat transmission.

Figuring Solar Heat Gains of Buildings, by William Goodman
No. 10, *No.* 6. *June,* 1938. *p.* 391
(Part 2); tables for estimating solar heat gains in buildings in calculating air conditioning loads; use of data for walls and roofs; color and texture of surface; time lag; solar heat through attic floor; examples.

Figuring Solar Heat Gains of Buildings, by William Goodman
Vol. 10, *No.* 7. *July,* 1938. *p.* 445
(Part 3); quantity of radiant heat impinging on a surface; formula for computing amount of energy falling on each square foot of a surface making any angle with the rays of the sun; tables of values of "cos *i*" for use in formula for various latitudes; computing the angle of incidence; diagrams illustrating derivation of formulas and the various angles.

Figuring Solar Heat Gains of Buildings, by William Goodman
Vol. 10, *No.* 8. *August,* 1938. *p.* 521
(Part 4); maximum solar energy falling on a black surface; theory of solar heat gains through bare glass; formulas; variation in solar energy transmitted and reflected by glass with changing angles of incidence; comparison between theoretical curve for solar heat transmitted through single glass and test points; tabulated values of fraction of solar heat transmitted through single and double glass.

Figuring Solar Heat Gains of Buildings, by William Goodman
Vol. 10, *No.* 9. *September,* 1938. *p.* 573
(Part 5); theory of solar heat gains through walls and roofs; formula for computing solar temperature differences of walls and roofs; values of solar temperature difference for dark walls and medium colored walls; correcting tabulated values for temperature differences other than 15 F; example; appendices showing derivations of Equations 3, 5, 7, 8 and 9 given in text.

Figuring Solar Heat Gains of Buildings, by William Goodman
Vol. 10, *No.* 10. *October,* 1938. *p.* 657
(Part 6); appendix showing derivation of Equation 10; computation of Table 11; conduction of heat through single glass when its temperature is raised by the internal absorption of solar energy; derivation of Equation 13 of text; diagrams illustrating conduction and absorption of heat by glass, and travel of solar heat through walls and roofs.

Ford's Standards for Air Conditioning, by J. J. Floreth
Vol 10, *No.* 2. *February,* 1938. *p.* 109
Air conditioning of Ford Twin City Branch, St. Paul, Minn.; example of Ford's standards; design conditions; load; data

on load and air circulation, tons of refrigeration required, etc., tabulated; plan of air conditioned areas; scheme of air distribution; grilles and ducts; machine room; capacity and bypass control for "Freon" compressors; compensating temperature control; units for factory offices; load factors.

Here's How I'd Air Condition an Office
Vol. 10, *No.* 3. *March,* 1938. *p.* 190
Readers of H. P. & A. C. tell how to air condition typical office suite in middle western office building; central units with ducts recommended; advantages and disadvantages of the various layouts; building manager comments on installing air conditioning systems in office buildings; location of equipment; use of air from building corridors; grilles in office doors; importance of proper air distribution; relation of air conditioning system to building heating system.

Hospital Installs Radiant Conditioning System, by C. A. Mills and John Gorrell
Vol. 10, *No.* 12. *December,* 1938. *p.* 762
Reflective radiant conditioning system installed in operating room at Blodgett Memorial Hospital, Grand Rapids, Mich.; satisfactory conditions maintained; to be used for heating in winter; illustration showing one of the panels.

Huge Weather Tunnel Tests Fords
Vol. 10, *No.* 8. *August,* 1938. *p.* 530
Brief description of weather tunnel for testing automobiles at Ford Motor Co.; 500 ton refrigeration system; size of tunnel and conditions that can be maintained.

Maintenance Routine for a Dust Control System, by Donald E. Frazier
Vol. 10, *No.* 5. *May,* 1938. *p.* 309
Importance of proper care and attention of dust control systems; description of Bird and Son, inc., crushing plant, East Walpole, Mass.; the dust arrester system; flow sheet of plant; procedure in taking dust counts; measuring static pressure; air velocities; minimum velocity for vertical conveying of solid particles; alterations and expansions to plant; filter house maintenance; necessity of regular inspections.

Moisture Control by Liquid Absorption Offers a Useful Air Conditioning Tool (an interview with F. M. Johnson)
Vol. 10, *No.* 12. *December,* 1938. *p.* 782
Principle of humidifying and dehumidifying by means of lithium chloride system; diagram of typical layout; advantages; arrangement for comfort air conditioning in large buildings; conditioning a Cellophane printing plant (Shellmar Products Co., Mt. Vernon, Ohio); windowless press room; conditions maintained; control; cylinder room air conditioned; importance of air conditioning such a plant.

Movie Makers, Brewers Need Air Conditioning
Vol. 10, *No.* 11. *November,* 1938. *p.* 726
Summary of address made by L. Logan Lewis before Society of Motion Picture Engineers; necessity of air conditioning sound stages; requirements; economic factor; paper on air conditioning in the brewery presented by C. I. Elliott before the Master Brewers' Association; control of biological changes by air conditioning; various applications of air conditioning in breweries.

New Hospital to Have Twelve Air Conditioned Operating Suites
Vol. 10, *No.* 10. *October,* 1938. *p.* 642
New surgical section of the George Robert White House, Massachusetts General Hospital, Boston, to have 12 completely air conditioned operating suites; double cleaning of the air; temperature and humidity requirements; spray washer type central station units.

New Tables of the Psychrometric Properties of Air-Vapor Mixtures, by William Goodman
Vol. 10, *No.* 1. *January,* 1938. *p.* 1
(Part 1); psychrometric tables computed from data in new Keenan-Keyes steam tables; how tables were computed; method of calculating heat to be removed when cooling and dehumidifying air; when moisture condensed from air freezes on cold cooling surfaces; enthalpy of air-vapor mixtures; enthalpy of water vapor; correct method of computing heat removed; equations; examples showing solution of typical problems; table of enthalpy of ice and low temperature water vapor; tables of properties of mixtures of air and saturated water vapor for temperatures from minus 40 to plus 200 F.

New Tables of the Psychrometric Properties of Air-Vapor Mixtures, by William Goodman
Vol. 10, *No.* 2. *February,* 1938. *p.* 119
(Part 2); approximate methods of computing heat to be removed when cooling and dehumidifying air; two commonly used methods of approximating enthalpy; chart showing that true enthalpy is almost constant for any one wet bulb temperature; use of tables of properties of mixtures of air and saturated water vapor, summary of results obtained by solving examples by correct and approximate methods; computation of absolute humidity; specific volume of dry air and air-vapor mixtures; appendices showing derivation of various equations and computation of the tables.

Noise Measurement, by H. F. Hagen
Vol. 10, *No.* 8. *August,* 1938. *p.* 533
Explanation of principles of noise measurement; equation for sound intensity; units of measurement; response of the human ear to noise; definition of "bel" and "decibel"; equations for decibels based on intensities and on pressures; sound meters; relationship between the three zero reference levels in use.

Omaha U Has Air Conditioning
Vol. 10, *No.* 9. *September,* 1938. *p.* 588
Brief description of air conditioning and heating of new Municipal University of Omaha building at Omaha, Neb.; summer cooling cycle uses well water augmented by two compressors.

Performance of Coils for Dehumidifying Air, by William Goodman
Vol. 10, *No.* 11. *November,* 1938. *p.* 697
(Part 1); new formulas for computing final dry and wet bulb temperatures of air leaving coil; final wet bulb depression depends upon initial wet bulb depression of the air for both direct expansion and counterflow coils; heat transfer across a wetted surface; over-all coefficient for a wetted surface; mean enthalpy difference for a direct expansion coil; area of wetted surface required for a direct expansion coil; final wet bulb temperature of air leaving wetted surface of direct expansion coil; final dry bulb temperature of air leaving a direct expansion coil; equations; factors for use in equations tabulated; diagrams.

Performance of Coils for Dehumidifying Air, by William Goodman
Vol. 10, *No.* 12. *December,* 1938. *p.* 777
(Part 2); surface temperatures of direct expansion coils; chart for determining surface temperatures of a wetted surface; table of angles for use with chart; "condition curve" for direct expansion coils; boundary dry bulb temperature of direct expansion coils; equations; examples.

Psychrometric Properties of Air-Vapor Mixtures, by William Goodman
Vol. 10, *No.* 4. *April,* 1938. *p.* 261
Tables of properties of air-vapor mixtures given in summary sheet form; equations for computing heat removed in cooling and dehumidifying air; determining enthalpy of saturated and unsaturated air.

Public Disappointment: Air Conditioning
Vol. 10, *No.* 4. *April,* 1938. *p.* 245
Brief review of article in "Fortune" magazine on Carrier Corp. and the air conditioning industry.

Reports Experience with Air Conditioned Hospital
Vol. 10, *No.* 3. *March,* 1938. *p.* 116 *(back section)*
Report on first year's experience with air conditioned Corey Hill hospital, by Dr. Albert G. Young, medical director; conditions maintained; effect of air conditions on patients; arthritis and rheumatic fever; results in treating patients; sinus infections, pneumonia, etc.; air conditioning a real adjunct to hospitals; air conditioned schools for children who suffer from rheumatic fever, asthma, hay fever and allied conditions predicted.

Reports Experience with Sheet Metal Fume Exhaust System
Vol. 10, *No.* 4. *April,* 1938. *p.* 240
Galvanized sheet metal used for fume exhaust system ducts for general science building, Antioch College, Yellow Springs, Ohio; building erected in 1929; advantages and disadvantages of sheet metal construction; coating ducts; corrosion reduced through use of open faced hood.

Safety Engineers Discuss Mine Ventilation and Heating
Vol. 10, *No.* 11. *November,* 1938. *p.* 720
Abstracts of papers presented at National Safety Congress; heating of air forced into mine to keep ice from blocking ventilation shaft; developments in mine ventilation; rock dust removal.

Selected Ultraviolet Radiations Sterilize Air at Army Laboratory, by W. A. Danielson
Vol. 10, *No.* 7. *July,* 1938. *p.* 450
Description of laboratory for making vaccines at Army Medical School, Washington, D. C.; precautions to eliminate contamination; use of air conditioning in cubicles in which vaccines are made; ultraviolet lamps in air conditioning duct sterilizes air; method of installing lamps; similar installation for operating and service rooms in Walter Reed hospital.

Servicing Air Conditioning Jobs, by W. A. Stains
Vol. 10, *No.* 6. *June,* 1938. *p.* 399
Refrigeration trouble shooting; location and selection of expansion valve; pipe sizing; piping layout; effect of restrictions in piping; king valves.

Servicing Air Conditioning Jobs—High Pressure in Condensers, by Melvin A. Ramsey
Vol. 10, *No.* 11. *November,* 1938. *p.* 702
Method of purging condensers to avoid waste of refrigerant; determining if purging is necessary; other reasons for and corrections of high pressure in condensers.

Servicing Air Conditioning Jobs—Refrigeration Trouble-Shooting, by W. A. Stains
Vol. 10, *No.* 4. *April,* 1938. *p.* 234
Indications of trouble on direct expansion air conditioning jobs; causes of various troubles; remedies.

Servicing Air Conditioning Jobs—Thermal Expansion Valves, by W. A. Stains
Vol. 10, *No.* 10. *October,* 1938. *p.* 664
Function and operation of thermal expansion valves; effect of spring; type and location of bulb; adjustment of valve; operating troubles and possible causes; sectional view showing hookup of diaphragm type thermal valve.

Simonds Saw Occupying Pioneer Windowless Plant
Vol. 10, *No.* 11. *November,* 1938. *p.* 711
Brief description of windowless factory of Simonds Saw & Steel Co., Fitchburgh, Mass.; ventilating; evaporative cooling; duct construction; exhaust hoods vent heat from equipment.

Specifying and Measuring Noise, by H. F. Hagen
Vol. 10, *No.* 9. *September,* 1938. *p.* 587
Examples of noise measurement and noise computations; position of microphone for measuring noise; how specification for noise should be written; method of figuring increase in room noise from unit heaters and ventilators; useful data on noise.

Storing Refrigeration for Air Conditioning
Vol. 10, *No.* 6. *June,* 1938. *p.* 395
General discussion of advantages and disadvantages of the refrigeration storage principle; increasing capacity of existing plant; initial cost of refrigeration equipment with and without storage; methods of storing refrigeration; storage system for a restaurant; storage system design developed by Carl F. Boester; control of water temperature.

Study Air Conditioning Costs
Vol. 10, *No.* 8. *August,* 1938. *p.* 534
Summary of preliminary survey on cost of air conditioning presented at annual convention of National Association of Building Owners and Managers; based on questionnaires covering 20 installations of 100 tons or over and 22 installations of less than 100 tons; average area served per ton of capacity, average cost per ton, average cost of installation per sq ft and annual operating and owning cost; check study based on proposals for installing air conditioning apparatus in 26 buildings.

Temperature Regulation in Modern Fruit Storage, by Clarence E. Baker
Vol. 10, *No.* 9. *September,* 1938. *p.* 589
Brief description of methods of air conditioning apple storages; study made of various means of securing thermostatic temperature regulation in a 55,000 bushel apple storage; effect of location of thermostat bulb; temperature charts for the various arrangements investigated; results of different operating methods.

Theory of Evaporative Cooling, by W. S. Bodinus
Vol. 10, *No.* 8. *August,* 1938. *p.* 531
Elementary discussion of principle involved in evaporative cooling; adiabatic saturation; influence of outside conditions; entering air conditions to spray chamber for room condition of 80 F and 50 per cent relative humidity; entering air conditions to spray chamber for room condition of 80 F and 65 per cent relative humidity; applications and limitations of evaporative cooling.

Tribune Tower Air Conditions Tested
Vol. 10, *No.* 7. *July,* 1938. *p.* 463
Engineering tests of Tribune Tower air conditioning systems

made by Otto W. Armspach; method of making tests; bacterial counts; formula for calculating amount of outdoor air entering room from carbon dioxide content of air; results of tests.

Union Pacific Air Conditions
Vol. 10, *No.* 3. *March,* 1938. *p.* 176
Illustration and brief description of air conditioning system for Union Pacific's headquarters building, Omaha, Neb.; twelve radial type compressor units; air circulation, volume and area of conditioned space, horsepower of motors, etc.; forced draft cooling tower; layout of piping.

Unusual Air Conditioning Problems Met in Designing New Glass Block Building, by James N. Livermore
Vol 10, *No.* 4. *April,* 1938. *p.* 241
Features of The Detroit Edison Company's new service building; air conditioning load peculiarities make zoning essential; analysis of cooling load; diagram showing load curves for various bays and arrangement of zones and thermostats; new design of mixing damper developed to improve control; characteristic curves for butterfly type and swing type mixing dampers; detail of new damper; thermostat settings varied automatically; master controller; location of thermostat bulbs; air introduced through perforated metal ceiling; perforated diffusing plate to insure good distribution; return air circuit; section through light coffer and duct; construction view of light coffers and ducts; control of static pressures; chilled water supplied by two centrifugal refrigerating machines.

U. of C. Air Conditions New Building, by Lyman R. Flook
Vol. 10, *No.* 7. *July,* 1938. *p.* 433
Design and construction of Public Administration Building at University of Chicago; first to be fully air conditioned and first erected since 1932; general description; insulation; air conditioning equipment; centrifugal refrigeration compressor; providing for flexibility in partition changes; air mixing and heating units; progressive views of installation of units; control; advantages of the scheme.

Visiting Firemen Hear Talk on Air Conditioning
Vol. 10, *No.* 10. *October,* 1938. *p.* 656
Brief report of address by L. Logan Lewis before convention of International Association of Fire Chiefs; fire control measures; necessity for clean duct work as means for fire control.

Waste Air for Drying, by John A. Phinney
Vol. 10, *No.* 7. *July,* 1938. *p.* 460
(Answer to a reader's question); use of waste high temperature gases for drying wet articles; final temperature of gas; amount required; relative humidity at high temperatures; rate of drying.

Waste Steam Air Conditions New University of Nebraska Building, by Conrad V. Carlson
Vol. 10, *No.* 11. *November,* 1938. *p.* 717
Brief description of steam jet equipment for supplying chilled water for air conditioning Student Activities building, Lincoln, Neb.; refrigeration equipment installed at power plant; insulation of chilled water piping; amount of exhaust steam available.

What Weather Does to Man, by William F. Petersen
Vol. 10, *No.* 9. *September,* 1938. *p.* 595
What weather does to the normal individual; the tropical effect; effect of differences in sex and human types; a few words on "health and air conditioning"; vast difference between indoor and outdoor temperature "physiologically preposterous."

Why Condition a Bakery? by W. E. Barnum
Vol. 10, *No.* 9. *September,* 1938. *p.* 570
Air conditioning of Helms Olympic Bakeries, Los Angeles, Calif.; 275 ton central station installation; system split into five zones; importance of bread cooling; 250 hp synchronous compressor motor connected by electric clutch may operate one or both compressors or run free to improve plant power factor; is complete bakery air conditioning justified? advantages of bakery air conditioning according to President Paul H. Helms.

World's Largest Plant Cools Congress, by M. S. Lebair
Vol. 10, *No.* 7. *July,* 1938. *p.* 436
Brief description of Capitol power plant, Washington, D. C.; refrigeration installation for air conditioning the Capitol and the Senate and House office buildings; six 800 ton reciprocating compressors; water piping; capacity figures.

General

Filing Technical Articles and Papers, by William Goodman
Vol. 10, *No.* 9. *September,* 1938. *p.* 597
Description of system for filing technical articles and papers; list of folders used; advantages of system.

HEATING, PIPING AND AIR CONDITIONING'S Show Section
Vol. 10, *No.* 1. *January.* 1938. *p.* 29
Special section on A.S.H.V.E., A.S.R.E., and N.W.A.H.&A.C.A. meetings in New York City in January, 1938, and the Fifth International Heating and Ventilating Exposition; general information on the week; programs for the meetings; list of exposition exhibitors and their exhibits; floor plans of exhibit space.

How to Acquire a Reference Library, by George T. Condron
Vol. 10, *No* 4. *April,* 1938. *p.* 250
Method of assembling and classifying articles and papers from back issues of publications; looseleaf binders used; arrangement of material; advantages of method.

Heating

Applying Control to Hotel Heating, by O. E. Stossel
Vol. 10, *No.* 11. *November,* 1938. *p.* 715
Importance of proper application of control; conditions influencing heat demand; radiator orifices; condensation in piping; a word of warning when installing control on a savings basis.

Cathedral Heated by Underfloor System, by T. Napier Adlam
Vol. 10, *No.* 7. *July,* 1938. *p.* 464
Description of underfloor, warm air, radiant heating system for Liverpool Cathedral; floor construction; conditions obtained; temperature gradient in cathedral; similar system applied to multistory buildings; a hospital installation; advantages of radiant heat in hospital operating rooms.

Control Systems for Oil Fired Boilers, by Paul R. Unger and Kalman Steiner
Vol. 10, *No.* 2. *February,* 1938. *p.* 101
Combustion control systems for three industrial boiler plants described and discussed; control for 150 hp H.R.T. boiler in Chicago factory of National Adhesives Co.; steam pressure deviation; closing of air ports; twin ignition; safety controls; complete wiring diagram showing various relays and switches; control of electric and steam operated oil preheaters; hot water heating system for new factory building of Lady Esther Co., Chicago; 125 hp Scotch marine boilers; method of preheating and control; safety and burner controls; motor starting switches; ignition; new boiler plant of Allis-Chalmers tractor plant, La Crosse, Wis.; three steel firebox boilers with two rotary burners each give flexibility; oil flow regulation; special pressure reducing valves; draft controllers; coordination of the various control devices.

Diesel Plant and Laboratory Salvage Electricity, Use It for Space Heating, by A. F. Davis
Vol. 10, *No.* 9. *September,* 1938. *p.* 567
Detroit Diesel Engine Division plant and laboratory of General Motors Corp. utilizes electric current generated by diesel engines on test for heating and process steam generation; description and diagram of the "heat and power pool"; oil fired boiler used when electric boiler cannot supply sufficient steam; laboratory heated by air passed over electrical grids; diagram of system for heating and ventilating laboratory; diagram of electrical hook-up.

District Heating Companies Point Way to Steam Savings, by George A. Orrok, Jr.
Vol. 10, *No.* 7. *July,* 1938. *p.* 459
Importance of utilization work to the district steam industry; how steam is wasted; how waste may be prevented; effect of utilization work on steam consumption of large hotel; method of charting "bogey" use of process steam.

District Steam Sales Rise, Cost Falls, by G. D. Winans
Vol. 10, *No.* 6. *June,* 1938. *p.* 367
Trends in district heating during last ten years; annual steam sales of 25 companies; revenue per 1000 lb of steam sold by 16 companies; improving customers' relations; controls; flow meters; reduction of capital and operating costs; use of steam for air conditioning; steam compressors; distribution system; steam generation.

Each Tenant in New Apartment Building Has His Own Gas Fired Heating System, by C. H. Cummings
Vol. 10, *No.* 1. *January,* 1938. *p.* 99
Each individual apartment in Parklake apartment house, Chestnut Hill, Mass., has its own gas fired furnace controlled by thermostat; air circulation; humidification; corridor, lobbies and stair wells heated by direct radiation; diagram showing method of installing furnace and ducts; reason for using method.

Economy in Plant Heating Aided by Fuel Consumption Yardstick, by C. C. Hermann
Vol. 10, *No.* 4. *April,* 1938. *p.* 246
By setting up a tentative temperature curve and initiating supervisory control system, economy in fuel consumption in plant heating is obtained; method of estimating fuel consumption; heat loss through open doors and methods of reducing; estimation of fuel requirements.

Forced Circulation Water for Heating and Cooling, by Samuel R. Lewis
Vol. 10, *No.* 1. *January,* 1938. *p.* 97
General discussion of features applied in year around air conditioning by the author's office; description of system for general office building of Jeffrey Mfg. Co., Columbus, Ohio; well water for cooling and warm water for heating circulated through coils; operation in spring and fall periods; method of control; duct reheaters; complications due to precipitate in deep well water; simplified diagram showing method of air circulation and control.

Fourteen Zone Hot Water System Heats Tuberculosis Sanatorium, by J. C. Pastor
Vol. 10, *No.* 2. *February,* 1938. *p.* 123
New 450 bed tuberculosis sanatorium near Orlando, Fla.; forced circulation, single main, hot water heating system with concealed copper radiation; plan of building showing shape and zoning; water heated by steam converters; control of water temperature; piping layout; method of recessing radiators; control of booster pumps.

Frank Lloyd Wright Uses Floor Heating for Johnson Wax Job
Vol. 10, *No.* 4. *April,* 1938. *p.* 238
New office building for S. C. Johnson & Son, Inc., under construction at Racine, Wis.; brief description; heating system comprises wrought iron pipe coils in floor slab; heating medium to be steam at sub-atmospheric pressure supplied from remote boiler plant; supporting floor coils; control of heating; air conditioning; insulation.

Graphic Records Aid Operation, by J. W. Esterline
Vol. 10, *No.* 6. *June,* 1938. *p.* 378
Use of graphical electrical meters in operation and maintenance of heating, piping and air conditioning equipment; supervising heating systems; improving pump operation; saving power for operating exhaust systems; reducing compressed air cost; reducing needless expense of excessive motor starts; miscellaneous examples.

Handling and Burning Oil at Sewage Treatment Plant, by E. W. Mautner and Kalman Steiner
Vol. 10, *No.* 12. *December,* 1938. *p.* 769
Brief description of process at Calumet sewage treatment plant of Sanitary District of Chicago; oil burners installed on sludge incinerators; construction of the furnaces; oil storage and piping; layout of oil handling and heating system; sludge and oil burners fire downward; regulation of draft and temperature; auxiliary boiler.

High Pressure Steam Adopted for Heating General Foods' New Mill
Vol. 10, *No.* 10. *October,* 1938. *p.* 643
Description of General Foods Corporation's new corn mill, Kankakee, Ill.; steam generated at 150 lb by stoker fired boilers; steam requirements; steam at 50 lb pressure used for plant heating; high pressure convector type radiation; propeller fan unit heaters; reasons for using high pressure steam for heating; same scheme to be used at new coffee plant at Hoboken, N. J.; process steam and piping.

High Pressure Steam Heats Consolidated School
Vol. 10, *No.* 5. *May,* 1938. *p.* 306
Consolidated School of Pleasant Township, Kouts, Ind., heated by system designed for operation at maximum pressure of 75 lb per sq in.; size of building and total heating cost per cu ft; cost per cu ft of school building heated by low pressure steam for comparative purposes; boilers are stoker fired; types of radiation used; illustrations of radiation, boiler room

and exterior building; advantages of using high pressure steam for heating.

Hot Water Heating System for New Campana Plant Has Novel Features, by Samuel R. Lewis
Vol. 10, *No.* 8. *August,* 1938. *p.* 527
New plant of Campana Sales Co., Batavia, Ill.; electric energy the only public utility service used; reasons for air conditioning; description of the heating and air conditioning systems; conditioning units have exhaust fans and supply fans driven by one motor; battery of 12 oil fired heating boilers installed; the well water system; control of the heating and air conditioning; details of boiler installation, water piping, fans and ducts, and layout of second story.

Hot Water System of Advantage in Meeting Plant Heating Requirements, by Samuel R. Lewis
Vol. 10, *No.* 5. *May,* 1938. *p.* 319
Description of new hot water heating system for large group of buildings of the American Manganese Steel Co., Chicago Heights, Ill.; advantages of hot water heating for industrial plants, particularly foundry buildings; high temperature hot water system using unit heaters; water circulated directly through oil fired boilers; boilers have special baffles; arrangement of flow and return mains; flexibility of system; value of roof and wall insulation.

How Improve Operation of Vapor Heating System?
Vol. 10, *No.* 4. *April,* 1938. *p.* 239
(Reader's question answered by Samuel R. Lewis); balancing a two pipe steam system; gas fired boiler; use of variable orifice vent valves; recommendations for improving control.

How to Avoid Waste in Plant Heating, by Mortimer Freund
Vol. 10, *No.* 3. *March,* 1938. *p.* 169
Industrial plants require heat for process heating, power, building heating and air conditioning, and domestic water heating; heating systems should be primary concern of management and ownership; types of troubles found in heating plants; seven ways to plant heating economy; radiators, pipe coils and unit heaters; many developments in controls; water heating and storage of hot water.

Industrial Plant Asks About Modernizing Boiler Installation, by Samuel R. Lewis
Vol. 10, *No.* 10. *October,* 1938. *p.* 656
Reply to subscriber's question about whether it would pay to change 200 hp boiler plant from coal burning to oil burning; over-all efficiencies for present plant, new oil burning boiler, and new stoker fired boiler; analysis of possible fuel savings.

Intermittent Heating of Buildings, by F. E. Giesecke
Vol. 10, *No.* 8. *August,* 1938. *p.* 515
Fundamentals of the problem; recommendations for percentage to add to capacity because of intermittent use of heating plant; analysis of a small building designed for use in studying intermittent heating; cooling between heating periods; temperatures of various parts of the structure; amount of heat stored in it; rates of heat loss; formula for cooling time; time to heat a building; comparison of heat requirements for continuous or intermittent heating; determining time when heating must be resumed in a building which is heated intermittently; heat loss when building cools one degree.

Motors in the Heating Plant, by Kalman Steiner and Fred Ravnsbeck
Vol. 10, *No.* 7. *July,* 1938. *p.* 441
Three types of direct current motors; characteristics and uses of the various types; starting direct current motors; types of alternating current motors, characteristics and applications; motor speeds; diagrams of motor connections and motor starters.

Motors in the Heating Plant, by Kalman Steiner and Fred Ravnsbeck
Vol. 10, *No.* 9. *September,* 1938, *p.* 577.
Non-technical description of single phase motors—split phase, repulsion induction, and capacitor types; diagrams of the motors; starting induction motors; styles of motor frames; explanation of "slip."

Novel Scheme Proposed for Heating Jail, by Samuel R. Lewis
Vol. 10, *No.* 1. *January,* 1938. *p.* 7.
(Answer to reader's request for criticism of method of heating cells in two story jail); suggests using 4 in. vertical pipe as heat emitting surface; horizontal pipe radiator recommended; location of valves and traps; importance of a means of control.

Performance of Mount Holyoke's Heating Plant, by D. W. McLenegan
Vol. 10, *No.* 8. *August,* 1938. *p.* 504
Brief description of central heating plant at Mt. Holyoke College, South Hadley, Mass.; 120 oil burner-boiler units; reasons for adopting unusual design; how system is controlled; performance of the plant; reasons for not using Bunker C fuel oil; table of fuel consumption per sq ft and per sq ft per degree day.

Proper Control of Air Circulation Important in Heating and Ventilating, by Lee P. Hynes
Vol. 10, *No.* 4. *April,* 1938. *p.* 229
Many factors besides size, shape and heat losses of structure must be considered in heating and ventilating; circulation of air; doorways; heating and ventilating garages and bus terminals; carbon monoxide; use of unit heaters in converting car barn to bus terminal; preventing cold drafts at doors; ventilating restaurant kitchens; preventing condensation in electrical substations.

Savings Within Six Years Will Repay Money Spent for Modernizing Heating, by Harry Duvendack
Vol. 10, *No.* 10. *October,* 1938. *p.* 660
Modernization of heating and power plant of National Republic Building, Chicago; one boiler equipped for gas burning to take advantage of low commercial gas rate during summer months; new stokers installed under two boilers; instruments and coal handling equipment installed; piping inspected and modernized; pounds of coal burned and pounds of water evaporated during winter months with old equipment and with new equipment; performance to date indicates that savings will pay for entire modernization program in about six years.

School Heating and Maintenance Discussed, by B. G. Elliott
Vol. 10, *No.* 7. *July,* 1938. *p.* 467
Summary of conference on school building heating and maintenance held at University of Wisconsin; importance of proper operation of heating and ventilating plants; the human element; use of stokers in State of Iowa; characteristics of coal; problem of purchasing school supplies; selection, purchase and use of fuels.

Steam Heating in the Sky
Vol. 10, *No.* 10. *October,* 1938. *p.* 631
Description of new Douglas DC-4, "world's largest and most luxurious commercial land plane"; heated by steam heating system with thermostatic control; development of plane heating; flash type boilers; boiler control; control of cabin temperature; complete air conditioning unnecessary; vibration and corrosion are problems.

Steam Pressure Control with Load Limiting Feature Aids Efficiency, an interview with V. E. Hupp
Vol. 10, *No.* 11. *November,* 1938. *p.* 712
Advanced method of steam pressure control employed for heating plant at Lincoln Park, Chicago; heating system and underground piping modernized; sudden temperature changes a problem; minimum boiler pressure 100 lb; master controls for regulating boiler pressure and heating system pressure; how controls operate to govern pressure reducing valves.

Stoker Rating Formula Adopted
Vol. 10, *No.* 7. *July,* 1938. *p.* 468
Stoker rating formula adopted by Stoker Manufacturers' Association establishes standard method for determining size of stokers for heating boilers and furnaces; formula; adopted by Heating, Piping and Air Conditioning Contractors National Association.

Twenty-Two Per Cent Less Steam Heats Office Building, by William S. Downs
Vol. 10, *No.* 3. *March,* 1938. *p.* 177
Description of how a New York office building has reduced its heating steam consumption; brief description of ventilating and heating equipment and piping layout; new pneumatic control valve pays for itself in four months; turbine driven vacuum pumps; inspection of impellers show corrosion and pitting due to oxygen in condensate; reducing valves; locating a leak in the piping; indirect heating coils partly cold; new method of trapping coils adopted; small leaks affect radiators; method of finding leaks.

Piping Connections for Unit Heaters, by Samuel R. Lewis
Vol. 10, *No.* 11. *November,* 1938. *p.* 706
(Answer to a reader's question); piping connections for three unit heaters supplied with steam from a central plant; trapping; air elimination; method of utilizing heat in the condensate; savings.

Zone Control Cuts Fuel Needed to Heat Huge Merchandise Mart, by W. A. Stahl
Vol. 10, *No.* 12. *December,* 1938. *p.* 759
Zone control and outside thermostats, and combustion control, installed at Merchandise Mart, Chicago, in fall of 1937; brief description of installation; results after one year's operation; lb of coal used before and after control; chart for January, 1938, showing fuel consumption and savings; floor plan showing location of thermostats, valves and piping; the boiler room equipment; fuel saving has been 20 per cent.

Piping

Big Tunnel Carries Piping Under Slip
Vol. 10, *No.* 10. *October,* 1938. *p.* 649
Brief description of piping service tunnel at Ford Motor Company's Rouge plant; illustration showing steps in construction of tunnel; number of valves controlling intricate system of underground water services at the plant.

Brass Piping Protects Product at Vermont Maple Sugar Plant, by Augustus Conlin (with Francis A. Westbrook)
Vol. 10, *No.* 9. *September,* 1938. *p.* 576
Use of brass piping for handling hot maple syrup at Cary Maple Sugar Co., St. Johnsbury, Vt.; brief description of piping and pumps; copper ducts remove vapor to prevent condensation.

Design and Fabrication of High Pressure, High Temperature Welded Piping, by F. C. Fantz
Vol. 10, *No.* 5. *May,* 1938. *p.* 329.
Three general classes of welds used in piping systems; butt welds; advantages of shop fabrication; recommendations for use of backing up rings; details of backing up rings for high pressure, high temperature service; fillet welds; branch and intersection welds; methods of making various types of welds; use of reinforcing saddles; table of reinforcing saddle sizes.

Dripping High Pressure, High Temperature Steam Piping, by Arthur McCutchan
Vol. 10, *No.* 8. *August,* 1938. *p.* 501
Importance and cost of drip piping; comparison of dripping superheated and saturated steam lines; effect of operating practice; hot drip system at Conners Creek plant; socket welded construction; materials used; gaskets; use of orifices; construction of multi-stage orifice; ratio of steam to water discharge capacity; use of impulse trap; principle of operation; test of ratio of superheated steam to hot water discharged; body and seating materials; method of connecting drip lines to steam pipe.

Drips and Drains for High Pressure Piping, by Walter Swanson and J. W. Hieronymus
Vol. 10, *No.* 5. *May,* 1938. *p.* 323
Drainage of condensate from high pressure, high temperature steam piping somewhat different problem from that with low pressure steam; construction of high pressure drainage equipment; trap capacity; valves for trap installations; use of condensate in piping; protecting valves; selecting trap capacity; protection from boiler priming; piping code requirements; double valved drains; details of typical installations; schematic diagram showing typical practice.

Factors Governing Heat Transfer in Kettles
Vol. 10, *No.* 4. *April,* 1938. *p.* 253
Resistances to heat flow in transferring heat from steam to the product being processed in a kettle; effect of thickness of metal; tests on nickel steam jacketted kettle; heat transfer coefficients.

From a Field Engineer's Notebook—Methods of Supporting Piping, by Allen M. Perry
Vol. 10, *No.* 12. *December,* 1938. *p.* 774
Sketches showing methods of supporting piping under various field conditions; key to finding types of supports for various conditions.

High Pressure Hot Water System Heats Molds at Plastics Plant, by F. A. Westbrook
Vol. 10, *No.* 6, *June,* 1938. *p.* 381
High pressure hot water system for heating molds at General

Electric plastics plant, Pittsfield, Mass.; per cent savings by using hot water; other advantages; the piping, boilers and pumps; temperatures; other applications.

High Temperature Piping Joints
Vol. 10, *No.* 2. *February*, 1938. *p.* 114
Report of A.S.M.E. meeting on high temperature joints prepared by F. E. Wertheim; stress conditions in welded branch connection; details of test manifold and reinforcing ring; test to destruction; high temperature bolted joints; pipe flanges subjected to creep; temperature variations and creep strength; piping "post mortems," illustrating headers and other specimens after test to destruction.

Holyoke Water Power Company Installs Industrial Steam Line
Vol. 10, *No.* 11. *November*, 1938. *p.* 718
Brief description of welded steam distribution system for supplying steam for process and heating at Holyoke, Mass.; welding of the piping; testing the piping; underground construction; starting up and operating the piping; trouble from dirt, pipe scale and welding chips; number of trap discharges.

How to Install and Operate Deep Well Turbine Pumps
Vol. 10, *No.* 11. *November*, 1938. *p.* 716
Information taken from deep well turbine pump section of "Standards" of Hydraulic Institute; what to check if pump will not start, will not deliver water, will not deliver sufficient water, if pump takes too much horsepower, if pump vibrates, and if there is excessive wear.

How to Use Reynolds' Numbers in Piping Design, by G. A. Gaffert
Vol. 10, *No.* 3. *March*, 1938. *p.* 174
Newer approach to piping design through use of Reynolds' numbers involving viscosity of steam and water is timely; with higher pressures and temperatures, older formulations are subject to greater errors; concept of viscosity; Reynolds' criterion; plot of Reynolds' criterion; viscosity of water; viscosity of steam; solution of problem in water flow; analysis applied to steam flow.

How Waterside's Piping Was Designed, by W. J. Angus and C. A. Kelting
Vol. 10, *No.* 8. *August*, 1938. *p.* 512
Installation of high pressure, high temperature topping turbines and associated boilers at Waterside Station of Consolidated Edison Co. of New York; selecting the pipe material; choice of allowable stress; calculations for wall thickness; boilerfeed discharge system; why welding was decided upon; illustrations of spherical mixing chamber or header.

Identification of Piping Systems
Vol. 10, *No.* 10. *October*, 1938. *p.* 651
Principal requirements of a standard scheme for the identification of piping systems; the American Standards Association scheme for identification; object and scope; definitions; method of identification; main classification by color; detailed instructions for working out a standard identification scheme; classification of materials carried in pipes; identification by colors; description of colors for special application; identification of piping systems by legends.

Inspection of Welded Piping, by William D. Halsey
Vol. 10, *No.* 11. *November*, 1938. *p.* 703
Important items in inspections; codes; development of welding procedure; qualifying the welding operator; the guided bend test; construction of guided bend tester; importance of following the welding procedure.

Largest Wood Pipe
Vol. 10, *No.* 3. *March*, 1938. *p.* 189
Illustration and brief description of 17 ft, 6 in. pipe of wood stave construction at Outardes, Que.

Long Pipe Line Ties in Steam Plants, Supplies New Continuous Strip Mill, by James M. Main
Vol. 10, *No.* 8. *August*, 1938. *p.* 524
New 98 in. continuous strip mill of Republic Steel Corp., Cleveland, Ohio; steam demand supplied by existing plant two miles below the site; why pipe line was installed instead of new steam plant; details and illustrations of piping construction; trap and valve cabinets.

Modern Piping Essential Service in the Molded Plastics Industry, by C. E. Herington.
Vol. 10, *No.* 4. *April*, 1938. *p.* 236
Molded plastics plant of Reynolds Spring Co., Cambridge, Ohio; brief description of hydraulic presses; piping services include 3000 and 500 lb hydraulic lines, 125 lb compressed air, 150 lb steam, 65 lb cold water, hydraulic returns, and combined condensate and warm water return lines; unit heaters.

Modern Practice in Piping Design, by Sabin Crocker
Vol. 10, *No.* 1. *January*, 1938. *p* 8
Detailed description of steam and boiler feed piping for 865 lb, 910 F extension of Delray power house No. 3, Detroit, Mich.; progress in high pressure and temperature plants; fuel saving; schedule of steam conditions at Delray; generating equipment; choice of materials for pipe and valves for 900 to 925 F; carbon molybdenum and carbon steel compared; chemical composition and physical properties of carbon molybdenum pipe; choice of the schedule of pipe to be used; welding end valves; impact tests; chemical composition and physical properties of nickel-chrome-molybdenum cast steel; precautions in welding alloy steels; choice of dimensional standards for 865 lb, 910 F; effect of thermal expansion; boiler feed piping and valves; piping layout for main steam and boiler feed piping; comparison of main steam piping in old and new sections of Delray; simplified boiler feed piping for extension; curve of allowable stresses at elevated temperatures for carbon steel and carbon molybdenum steel plate; curves showing allowable stresses at elevated temperatures for Grade B and Grade C seamless pipe; illustrations of scale models for the Delray extension.

New Data for Refrigeration Piping—Ammonia Suction Line Piping, by R. C. Doremus
Vol. 10, *No.* 1. *January*, 1938. *p.* 21
Pressure drop in ammonia suction lines; importance of good design; components of pressure drop; table of pressure drop due to valves and fittings expressed in equivalent length of straight pipe; charts of pressure drop in ammonia vapor suction lines per 100 lineal feet of pipe for various size piping and for temperatures of 0 F and 41 F; velocity table for ammonia suction vapor at various suction temperatures in feet per minute per ton of refrigeration; examples showing use of the data in selecting proper size of suction piping.

New Data for Refrigeration Piping—Carbon Dioxide Liquid and Suction Lines, by R. C. Doremus
Vol. 10, *No.* 2. *February*, 1938. *p.* 105
Characteristics of carbon dioxide; capacities of CO_2 liquid lines; flash gas in risers; suction vapor characteristics; suction pipe line sizes; velocity chart for carbon dioxide suction vapor at various temperatures for extra heavy steel pipe of different diameters in feet per minute per ton of refrigeration; examples showing use of data; importance of bracing carbon dioxide piping. (Also see p. 253, April, 1938, issue.)

Oxidation of Steel by High Temperature Steam
Vol. 10, *No.* 4. *April*, 1938. *p.* 247
Abstract of progress report of A.S.M.E. research committee on critical pressure steam boilers, by F. E. Wertheim; test program at Purdue University; apparatus for conducting tests; occlusion investigated; results of investigation; effect of steam pressure upon oxidation of low carbon steel by steam; effect of temperature on weight of scale formed; comparative oxidation of six different steels in contact with steam at 1100 F and 175 lb.

Oxy-Acetylene Heating for Bending, Straightening and Forming by H. H. Moss
Vol. 10, *No.* 10. *October*, 1938. *p.* 662
Many forging, forming, straightening, bending and pressing operations can be performed with the aid of the intense, localized heat of the oxy-acetylene flame; advantages of the oxy-acetylene flame; typical applications.

Piping and Heating Maintenance Costs
Vol. 10, *No.* 6. *June*, 1938. *p.* 380
Steam generation report form and maintenance detail sheet developed by Alfred Vaksdal, plant engineer, Corning Glass Works; advantages and use.

Piping for Indirect Refrigeration, by R. C. Doremus
Vol. 10, *No.* 3. *March*, 1938. *p.* 186
Advantages and disadvantages of indirect refrigeration systems; water as an indirect refrigerant; use of calcium chloride brine; chart showing quantity of water required for various capacities in tons of refrigeration for different temperature ranges; similar chart for calcium chloride brine; chart of calcium chloride brine freezing points; chart showing pipe friction multipliers for use with calcium chloride brine of various specific gravities.

Piping for Indirect Refrigeration, by R. C. Doremus
Vol. 10, *No.* 4. *April*, 1938. *p.* 251
Application of sodium chloride brine for indirect refrigeration; specific gravities and freezing points for brines of various strength; amount of brine circulated for various refrigeration capacities; chart for estimating pipe friction; piping materials for calcium chloride and sodium chloride brine systems; brine corrosion and corrosion retardants; pH tests of brine samples; pipe friction chart for water.

Piping Review
Vol. 10, *No.* 2. *February*, 1938. *p.* 108
Tables summarizing information on piping at Conners Creek, Delray, Market Street, Mountain Creek and Riverside central stations; the following items tabulated—piping service, pressure and temperature, diameter and wall thickness, composition of pipe, method of making joints, gaskets, valve body and trim, and whether welded joints were stress relieved and x-rayed. (Also see p. 599, September, 1938, issue.)

Piping Review
Vol. 10, *No.* 9. *September*, 1938. *p.* 599
Tabulation supplementing similar data given in February, 1938, issue on recent piping installations; name and location, engineers and contractors, piping service, pressure and temperature, diameter and wall thickness, pipe material, kind of gaskets, and other information.

Practical Suggestions for Reducing Piping Corrosion
Vol. 10, *No.* 5. *May*, 1938. *p.* 312
Method of installing piping has important bearing on service life; suggestions for making threaded joints to prevent corrosion failures; avoiding contact between dissimilar metals; importance of venting underground conduit; recommendations for underground lines that must pass through cinder fills; corrosion; water treatment and deaeration; importance of proper slope or pitch.

Recent Progress in Flange Design, by F. S. G. Williams
Vol. 10, *No.* 7. *July*, 1938. *p.* 448
Review of research work on flange design; the flange design problem; effect of hub section; joint committee on bolted flange connections; data published on modern flange design; calculation sheet forms for design of integral and loose flanges.

Rectangular Tubing Used as Refrigeration Piping, by William B. Vilter
Vol. 10, *No.* 11. *November*, 1938. *p.* 710
Use of rectangular steel tubing in freezer room at H. A. Nieman & Co., Thiensville, Wis.; shelf coils made of rectangular tubing promote contact between tubing and product; method of freezing peas.

Research Committee Studies Grounding of Electrical Circuits on Piping, by H. S. Warren
Vol. 10, *No.* 8. *August*, 1938. *p.* 526
Protective grounding of electric circuits on piping being studied by American Research Committee on Grounding; objectives of committee; progress of studies to date; secretary should be notified of cases to be investigated.

Safety Pays Dividends, Steel Company Finds
Vol. 10, *No.* 10, *October*, 1938, *p.* 633
Jones & Laughlin Steel Corp. have proved that safety pays dividends; safety factor given special consideration in planning and construction of 96 in. continuous mill; hydraulic piping to descaling sprays shielded to protect employees.

Standardization in the Valve and Fittings Industry, by John J. Harman
Vol. 10, *No.* 3. *March*, 1938. *p.* 180
Advantages of standardization; application local at first; history of standardization activities in valve and fittings industry; active standards now in effect; list of M.S.S. standard practices; list of American standards developed by sectional committee B16; the unfinished business of standardization.

Swivel Joints Simplify Process Piping, by Oliver J. Haller
Vol. 10, *No.* 9, *September*, 1938. *p.* 572
Unique arrangement of piping and swivel joints for transferring fluid from one vessel to another; installation in a sulphate pulp mill; piping and connections arranged so that

discharge from digester can pass through any two of six diffusers in series; details and illustration of the installation.

$200,000 Award Program Indicates Possible Savings by Use of Welding
Vol. 10, *No.* 12. *December*, 1938. *p.* 775
Review of papers receiving awards in "Containers—Contents Moving" classification of James F. Lincoln Arc Welding Foundation award program; modernization of a brewery with arc welded piping; fermenting tank attemperators; cost of welded joints; high pressure, high temperature valves; welded piping for paper board machine; water piping for air cooler in slabbing mill; welded main air header at sewage purification plant.

Uniform Marking of Valves and Fittings, by John J. Harman
Vol. 10, *No.* 7. *July*, 1938. *p.* 437
Detailed discussion of MSS Standard Practice No. SP-25-1936, standard marking system for valves, fittings, flanges and unions; general rules for marking; exceptions to general rules; symbols signifying class of service; valve trim symbols; thread identification marking; diagrams showing body marking and identification plate for a valve; acceptance of the standard. (Also see p. 506, August, 1938, issue.)

Use of Backing Rings in Welding High Pressure, High Temperature Piping, by Sabin Crocker
Vol. 10, *No.* 7. *July*, 1938. *p.* 466
Discussion of article on "Weld Design for High Pressure, High Temperature Piping" published in June, 1938, issue; use of backing rings; design of backing rings; material; proposed standard for bevelling of welding ends; "backing" ring a preferable term to "chill" ring.

Use the New American Pipe Standard, by H. H. Morgan and Sabin Crocker
Vol. 10, *No.* 10. *October*, 1938. *p.* 634
Development of the American Standards Association B36.10 standard for wrought iron and wrought steel pipe; limitations of the earlier standard weight, extra strong, and double extra strong schedules—thin walled pipe needed for welding, intermediate pressures call for new thicknesses, no sizes over 12 in. in old standards, old standards not consistent for uniform pressures; standardization eliminates useless duplication; basis of B36.10 standard dimensions; computation of wall thickness for given service conditions; former standard weight and extra strong now Schedules 40 and 80; getting the new standard into use; table of dimensions of welded and seamless steel pipe; graph showing nominal pipe size vs. wall thickness.

Valves—a Review of Available Types and Their Features, by F. H. Morehead
Vol. 10, *No.* 6. *June*, 1938. *p.* 374
Classification of valves according to path of fluid and nature of opening and closing mechanisms; special features of various types of valves illustrated and discussed.

Weld Design for High Pressure, High Temperature Piping, by J. H. Deppeler
Vol. 10, *No.* 6. *June*, 1938. *p.* 398
Importance of weld design for successful arc welding of high pressure, high temperature piping; details of various designs for horizontal and vertical welds; use of chill rings; recommendations.

Welded Joints in Carbon-Molybdenum Piping, by R. W. Clark
Vol. 10, *No.* 11. *November*, 1938. *p.* 712
(Part 1 of paper presented at annual meeting of American Welding Society); tests on arc welded joints made to determine effect of groove design, whether or not general chipping of each bead is necessary, and value of recording voltmeter for checking soundness of welded joint; four types of grooves; sketch of pipes set-up for welding, showing position of gas heating apparatus and thermocouples; summary of welding procedure for each joint; typical arc voltage records; reproduction of radiograph; typical welded specimens after testing; photomacrographs and photomicrographs of sections of two welded pipe joints; conclusions based on the tests.

Welded Joints in Carbon-Molybdenum Piping, by R. W. Clark
Vol. 10, *No.* 12. *December*, 1938. *p.* 767
(Part 2); results of series of tests made to determine the residual stresses in pipe joints welded at three different temperatures when tested in the "as welded", "furnace stress relieved", and "local stress relieved" conditions; illustrations of samples; deflection curves of strips cut from the pipes.

Welded Piping in the Sulphur Industry, by O. B. McLaughlan
Vol. 10, *No.* 4. *April*, 1938. *p.* 259
Method of installing and welding piping for Freeport Sulphur Co. plant, Grande Ecaille, La.; fabrication of large water line; backhand welding method used; fabricating channel crossings; tool developed for lining up pipe for tacking crew; power plant piping welded by ripple method; testing the piping; problems encountered in production of sulphur; use of inner steam pipe or "gut" line in sulphur piping to maintain desired temperature.

Welding High Pressure, High Temperature Piping, by W. J. Angus and C. A. Kelting
Vol. 10, *No.* 9. *September*, 1938. *p.* 581
Welding high pressure, high temperature piping at Waterside Station of Consolidated Edison Co. of New York; weld details; backing rings; diagrams of pipe-to-pipe and pipe-to-fitting joints and socket end welding fittings; valve design and installation; stress relieving; support of the piping; x-ray examination of welds; method of taking exposures for radiographic examination of welded joints.

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The Editor's Page

The Air Hygiene Foundation's fall meeting at Mellon Institute, Pittsburgh was attended by some 250 industrial leaders, technical specialists, government officials, physicians and engineers, who heard reports of the Foundation's medical, engineering and legal committees on recent advances toward the control of occupational disease and current developments in the field of industrial health. . . . Prof. Philip Drinker, chairman of the preventive engineering committee, reported that "one of the most significant developments in the field of occupational hygiene during the past year has been the adoption of New York State's code governing dustiness in rock drilling. The code divides all rock formations into two classes, class I being those with less than 10 per cent free silica, by weight, and class II being those with more than 10 per cent free silica. If drilling is done in class I rock, dust counts must be below 100 million per cu ft, and below 10 million particles if the rock falls in Class II. . . . This means, in effect, that dry drilling can only be used with local exhausts and adequate air cleaning. It happens, also, that wet drilling without ventilation will not achieve adequate air cleanliness in the case of the high quartz or class II rock. . . . At this writing it seems very likely that other states will copy this code almost verbatim. It is probable that substantially this same code will be adopted for dust exposures of all kinds. If so, it will mean that the upper limits of dustiness in any kind of work and in any kind of dust will be 100 million particles per cu ft."

The small business man and retailer concerned over business conditions is "turning to air conditioning as a way out," according to L. R. Boulware of Carrier Corp. at a three-day meeting last month at the new Syracuse plant. The retailer knows from experience the only way he can meet competition is to make shopping and working conditions more attractive for buyers and employees alike, says Mr. Boulware. . . . His views are supported by B. J. Friedman, president of Bond Stores, Inc., noted for progressive merchandising methods. According to Mr. Friedman (quoted in the "Air Conditioning News" issued by the Philadelphia Electric Co.) Bond's know that air conditioning attracts customers and, when purchasing in comfortable surroundings, they take time to make a more discriminating selection; salesmen are also more efficient and give better service. . . . Bond's experience has shown that air conditioning is economically justified and has become a "virtual necessity" in the modern store.

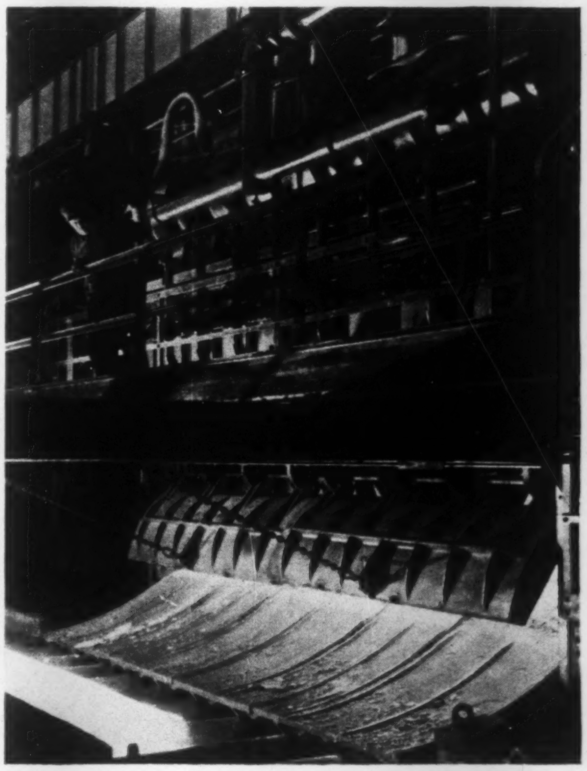
Presenting a report on four years' experience in comparing the benefits of air conditioning upon employees working in air conditioned offices and in non-conditioned offices, H. H. Mather of the Philadelphia Electric Co. said recently that the indicated average reduction in lost time from respiratory illnesses is 34 per cent among the workers in the air conditioned test offices. . . . Savings in lost time so far disclosed indicate that they offset from 50 to 75 per cent of the cost of owning and operating an air conditioning system, said Mr. Mather in a story given in the November "Air Conditioning Trends," issued by the Publisher of HEATING, PIPING AND AIR CONDITIONING.

The tremendous spread of air conditioning is opening up wide new horizons of opportunity for introduction of refrigeration machinery, declared J. M. Fernald, vice-president and general manager of the Baker Ice Machine Co., on his recent re-election to the presidency of the Refrigerating Machinery Association. Mr. Fernald has announced continuation of the association's program of technical standardization work. . . . H. Sidney Smith was awarded the James Turner Morehead medal for the year 1936 by the International Acetylene Association. The medal is given annually to the person or persons who in the judgment of the association's officers and directors have done most to advance the industry or the art of producing or utilizing calcium carbide or its derivatives. . . . Mr. Smith was the recipient also of the Samuel Wylie Miller medal of the American Welding Society this year.

Their new windowless air conditioned office and laboratory building is described and pictured in a booklet issued by the National Aluminate Corp., Chicago. The booklet reprints Robert E. Hattis' article describing this unique air conditioning system from the February, 1937 HEATING, PIPING AND AIR CONDITIONING. . . . Mr. Hattis was the consulting engineer. . . . Walter L. Upson, professor of electrical engineering at Washington University, assumes charge this month of research for the Torrington Mfg. Co., giving special attention to fans. . . . Author of a number of technical articles and books, Professor Upson was associated early in his career with the late Dr. Elmer A. Sperry and as assistant to Dr. C. P. Steinmetz.

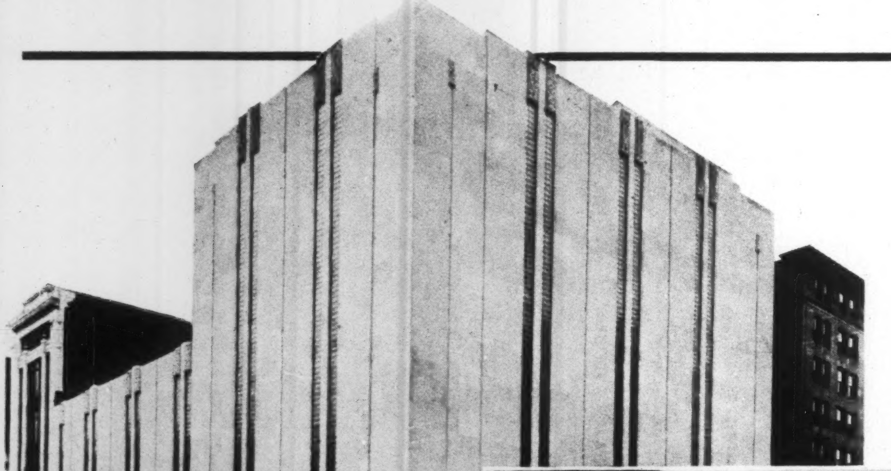
Installed cost of equipment sold by the members of the Air Conditioning Manufacturers' Association in October totalled $3,054,187, compared to $3,537,707 in the same month of 1936, a decrease of 13.67 per cent, according to William B. Henderson, executive vice-president of the A. C. M. A.

A white hot steel slab (illustration), heated to the correct rolling temperature of 2250 F, slides from the heating furnace on to a roller table at the Jones & Laughlin continuous mill at Pittsburgh for the manufacture of wide steel strip and sheets and steel plates. . . With an annual capacity of three-quarter of a million tons, the mill covers 23 acres; production was begun on the first completed unit last spring, additional units being brought in during the summer and fall until all departments are now in production.



IN THIS MODERNIZED STORE

ARMSTRONG'S CORK COVERING AIDS MAXIMUM AIR CONDITIONING EFFICIENCY



LEFT: *Modernized department store of H. P. Wasson Company, Indianapolis, Ind. Rubush and Hunter, Architects; Berington and Williams, Engineers, all of Indianapolis.*

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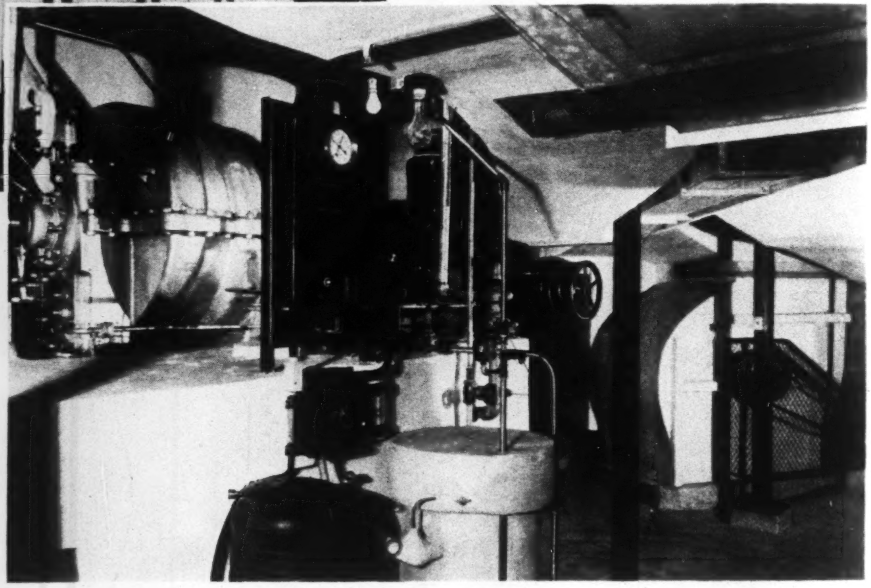


BELOW: *A 4" thickness of Armstrong's Corkboard insulates this 175 ton Carrier Centrifugal Compressor and ice water thickness Armstrong's Cork Covering and Fitting Covers guard the 6", 7" and 8" cold water circulating lines.*

Cold water circulating system is completely insulated for refrigerating economy

•

IN the modernized department store of the H. P. Wasson Company in Indianapolis, four sales floors and a basement restaurant are air conditioned. A central refrigerating system supplies cold water to several "Weather Maker" units. To prevent refrigeration losses, cold water lines in the circulating system are insulated with Armstrong's Cork Covering and Fitting Covers.

On all cold lines Armstrong's Cork Covering guards against refrigeration waste, cuts operating costs, and assures a minimum temperature drop in even the longest runs. Cork's unique cellular structure effectively resists the passage of heat and the penetration of moisture. The accurate fit of this insulation on pipes and fittings and its rigidity which prevents sagging away from the line, are important aids to long, efficient service. When Armstrong's Cork Covering is used there are no weak spots in the insulation of the entire system.

For ducts and equipment and for buildings, Armstrong's Corkboard also offers dependable insulation. For quieting fans and equipment use Armstrong's Vibracork.

Let Armstrong engineers work with you in planning insulation for air conditioning work. For full information write Armstrong Cork Products Co., Building Materials Division, 994 Concord Street, Lancaster, Pa.

Armstrong's CORK COVERING

CORKBOARD INSULATION **VIBRACORK**

The Editor's Page

■ Potential market for air conditioning is immense and largely untouched, and technical progress has developed machinery and equipment which enables the industry to supply the market efficiently and economically, says Royce A. Wight of Mackubin Legg & Co. in a recently issued survey of the industry. Estimated sales of $300,000,000 per annum within 10 years do not exceed the realm of possibility, the survey says. . . . In a survey by Fitch Investors Service it is estimated that within 10 years the aggregate value of air conditioning in use will exceed $2,000,000,000 and at that time replacement and service needs alone should total about $350,000,000 annually. . . . Peter B. B. Andrews of Hemphill, Noyes & Co. has found no major industry with the sustained growth potentialities of air conditioning, he reports in a recent discussion of air conditioning.

■ Standards for welding electrodes have recently been adopted by the electric welding section of National Electrical Manufacturers' Association and arrangements have been made to distribute them through member companies and from N.E.M.A. headquarters at 155 E. 44th St., New York, N. Y. The principal functions of these standards are to define the various classes of metallic electrodes used in arc welding, and to standardize the packaging, diameters and lengths of the various types of electrodes. . . . For the purposes of standardization, electrodes are divided among the following classes: bare, thinly coated, heavily coated, high tensile, hard surfacing, ferrous for cast iron, corrosion and scale resisting alloy, non-ferrous, and miscellaneous.

■ The A.S.H.V.E. announced last month publication of the 1938 "Heating, Ventilating and Air Conditioning Guide," the 16th consecutive edition, containing 840 pages of reference data divided into 45 chapters. Important new material has been added on the cooling phases of air conditioning. . . . Approximately 100 different experts assisted the publication committee—under the chairmanship of Albert Buenger—in compiling the volume. . . . Single copies are available for $5.00 from the Society.

■ Air conditioning was ruled a "conservation of assets" rather than a "speculative investment" in the first step of a recent court test involving the remodeling of an 18 story building in New Orleans, according to Carrier Corp., who has contracted to supply the equipment. . . . The court held that air conditioning would conserve the assets, particularly since tenants had agreed to a raise in rental, and on the other hand would move out if the building were not air conditioned. . . . In a recent lecture on air conditioning, Arnold H. Goelz, president of Kroeschell Engineering Co., said that continual research and engineering development of refrigerating units for air conditioning has reduced both weight and space required per ton to about one-sixth that of 30 years ago when comfort cooling was just beginning. He gave the following comparative figures:

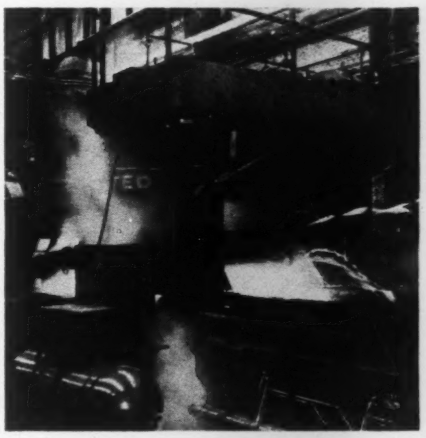
Year	Space per Ton	Weight per Ton
1908	100%	100%
1918	77%	86%
1928	27%	42%
1938	14%	16%

■ There were more meetings of A.S.T.M. standing committees and their sub-groups and sections during the committee week in Rochester, N. Y., last month than in any similar series in previous years; total registration was 662. . . . A number of new specifications and tests were approved, and two new standing committees—one on radiographic testing and one on thermal insulating materials—were announced. . . . The American Welding Society has appointed a board of awards composed of H. L. Whittemore, G. T. Horton, and A. G. Oehler to select the recipient of the Lincoln gold medal for 1938, donated by J. F. Lincoln, president of Lincoln Electric Co., to encourage presentation before the A.W.S. of papers effective in promoting use of welding.

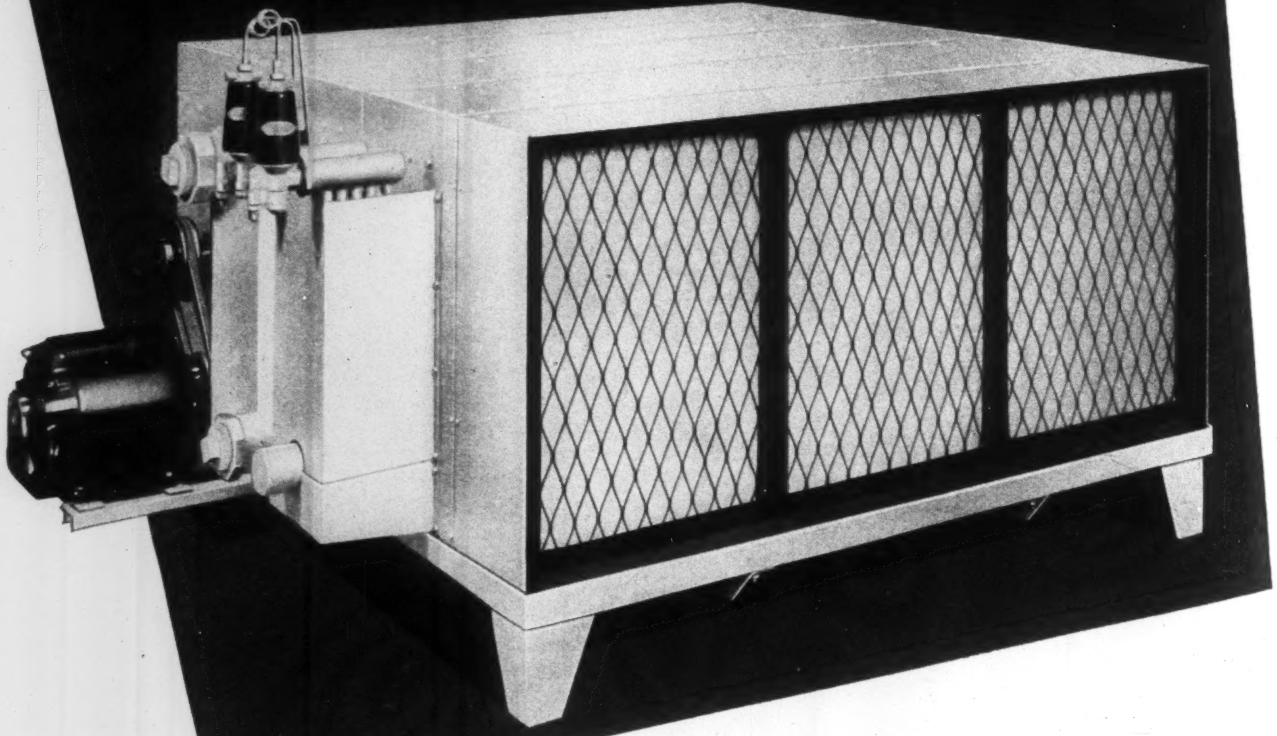
■ The first completely air conditioned bus fleet ever built is to be put in service soon by Santa Fe Trailways, it was recently announced. . . . With many modern features, the fleet of fifty 36 passenger buses will be used on major routes; future units are planned for other areas.

■ Poor air conditioning installations constitute a "serious fire hazard" because of the forced drafts they employ, according to C. W. Gustafson of the Mutual Fire Prevention Bureau at a recent conference of fire insurance experts. According to Mr. Gustafson, ducts should be lined with non-inflammable material, filters should be of non-inflammable material, and if oil is used for coating, it should be of a high flash point. When air conditioning ducts pierce fire walls or floors, they should be equipped with thermostatic dampers and when the air cooling system connects directly with the air conditioning ducts, a non-flammable and non-toxic refrigerant should be used.

■ Republic Steel formally opened its new 98 in. hot and cold strip mills at Cleveland last month. The mills roll strip steel 94 in. wide from slabs which speed through a series of electrically controlled roughing and finishing mills to the coiler almost a quarter of a mile away in as little as 240 seconds. The plant has a capacity for producing a million tons of hot and cold rolled sheet and strip per year. . . . Maximum steam requirements of the plant are 100,000 lb per hr which is conveyed through over two miles of pipe—said to be the largest single electrically welded steam line installation in the country. . . . The illustration below shows a slab just discharged from one end of the slab heating furnaces entering the roughing scale breaker where scale is removed by a spray of water under 1200 lb per sq in. pressure.



make it Stronger — reduce dead weight!



The base frame of this air conditioning unit is made of Armco H. T.-50. It is light in weight, yet rigidly reinforces the entire unit and maintains alignment.

SOUND structural design in air conditioning units is important to sales, installation and performance. Armco H. T.-50 permits compact, weight-saving design, yet provides ample strength for rigidity and perfect alignment.

Here is an improved high tensile steel that meets every demand for workability, weldability, uniform flatness and a good surface. Armco H. T.-50 has a minimum yield strength of 50,000 pounds per square inch. With proper design, you can use lighter gages and save weight and space. The danger of structural failure from vibration is less because of its high fatigue (endurance) limit of 48,000 pounds per square inch. Atmospheric corrosion resistance is four to six times that of ordinary steel.

Design your units with Armco H. T.-50 to reduce weight and increase strength and durability. Use it with assurance of completely satisfactory service. We will gladly help you apply it. The American Rolling Mill Co., Executive Offices, 1331 Curtis St., Middletown, Ohio.

ARMCO

Armco H.T.-50

The Editor's Page

■ **138 department stores** were air conditioned last year in the zones of 103 reporting utilities operating in sections totalling 50,000,000 population, according to William B. Henderson, executive vice-president of the Air Conditioning Manufacturers' Association. . . . These jobs represented 2.07 per cent of the units installed in the districts and 12.64 per cent of the horsepower placed in commission there for air conditioning. In the same areas, department store installations were 1.59 per cent of the units and 15.74 per cent of the horsepower in 1936 and 2.34 and 14.27 per cent in 1935. . . . More than 700 department stores now have air conditioning, complete or in part, with a steadily increasing trend toward full equipping at the outset, based on observation of results accomplished in other establishments, says Mr. Henderson.

■ **Comfort for customers** and for employees pays dividends, according to A. D. McLay of The Detroit Edison Co. in a recent address before the sales conference of the Edison Electric Institute. . . . Reporting a survey of users asked "To what extent has air conditioning increased your summer business?", he stated 4 per cent said it had increased business 100 per cent, 6½ per cent said it had increased business 50 per cent, 3 per cent said it had increased business 35 per cent, 42 per cent said it had increased business 25 per cent, 9½ per cent said it had increased business 20 per cent, 3 per cent said it had increased business 15 per cent, and 22½ per cent said it had increased business 10 per cent.

■ **The purchase of several** thousand pages of business publication advertising space has made Mrs. Mabel Potter Hanford a keen judge of those qualities of a business publication which will insure the most effective advertising job. She has set down the fruits of her experience in a book just published by Harpers ($2.50) entitled "Advertising and Selling Through Business Publications." . . . Her book is of very practical value and interest to buyers of advertising in the business press. Among the subjects discussed are the place of business publications in the advertising program, what is meant by business publications, markets and their media, circulation methods and the reports of audit bureaus, advertising rates, agency commission and scheduling of space, publication promotion and reader surveys, and advertising copy for business publications.

■ **Importance of** educational efforts to promote use of the American Tentative Standard for wrought iron and wrought steel pipe was emphasized at an A.S.A. sectional committee meeting recently. . . . The committee found that practically all of the standard's pipe schedules are completely acceptable and recommended that it be advanced to the status of an American Standard instead of a Tentative Standard. . . . According to "Industrial Standardization," a readjustment from 0.375 to 0.437 in. in the wall thickness of the 16 in. outside diameter size in schedule 30, Tables 2 and 4, with corresponding changes in Tables 3 and 5, was recommended as the only technical change.

■ **Air conditioning is playing** an increasingly important role as an arm of the national defense in European countries, according to W. L. Fleisher, chairman of the A.S.H.V.E. committee on research and member of H. P. & A. C.'s Board of Consulting and Contributing Editors, who recently returned from a six week's trip to England, France and Belgium. . . . Citing the use of air conditioning in the manufacture of munitions and ventilation of subterranean retreats for the civilian population in the case of air raids, Mr. Fleisher indicated that air conditioning was being studied very carefully in its relation to protection against poison gases. In England, he consulted with the British war department on this subject.

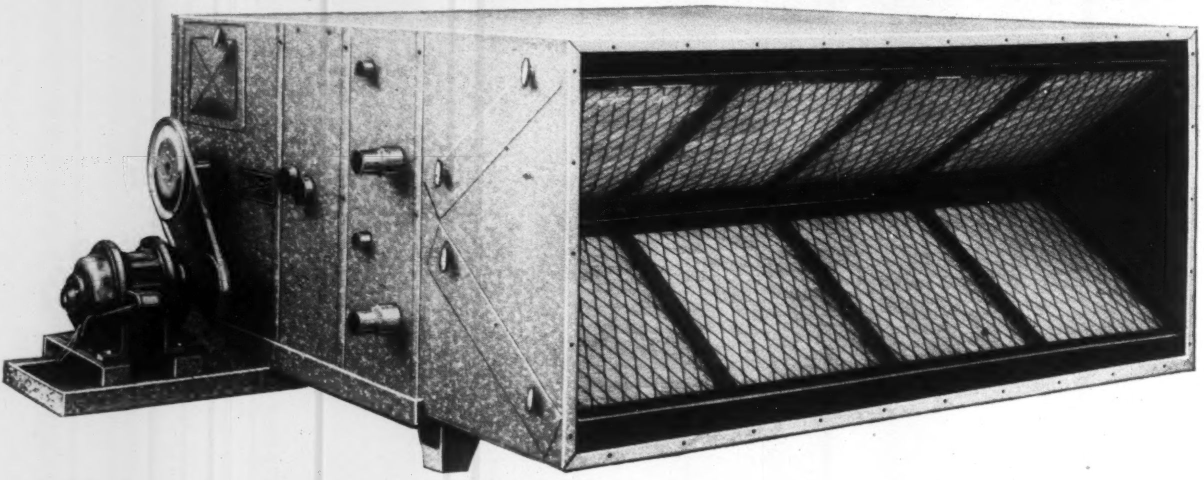
■ **John J. Harman's article** on standardization in the valve and fittings industry which appeared in the March HEATING, PIPING AND AIR CONDITIONING, was reprinted in the March "Industrial Standardization," organ of the American Standards Association. . . . Mr. Harman is general secretary of the Manufacturers Standardization Society of the Valve and Fittings Industry, and a member of H. P. & A. C.'s Board of Consulting and Contributing Editors. . . . R. C. Doremus, chief engineer of the Detroit Ice Machine Co. and member of H. P. & A. C.'s Board of Consulting and Contributing Editors, was elected chairman of the Air Conditioning Association of Michigan at the recent organization meeting. . . . The group voted to adopt an "official analysis form" to be submitted to the prospective owner of an air conditioning system with the formal proposals.

■ **William Goodman,** well known to H. P. & A. C. readers through his authoritative articles on air conditioning, piping and heating, and member of H. P. & A. C.'s Board of Consulting and Contributing Editors, is the author of "The Trane Air Conditioning Manual" ($5.00), published last month. . . . Comprising 333 large size pages, substantially bound, the volume is packed with practical data on heat, comfort, heat gains, properties of air, calculation methods, refrigeration, water requirements for air conditioning, and includes numerous problems and reference tables. . . . Primary purpose was "to assemble and present factual material on air conditioning so that the student can obtain a well organized, coherent grasp of the subject."

■ **Mineral wool manufacturers** producing about 95 per cent of the mineral wool manufactured in the U. S. for industrial and home insulation announced last month the new name of their organization—National Mineral Wool Association. Headquarters are at Rockefeller Center, New York City, and the secretary is Wharton Clay.

■ In contrast to twin brother Auguste, Dr. Jean Piccard, professor of aeronautics at the University of Minnesota, is studying the stratosphere from the ground. Here he is discussing the intricate subject of air pressure, methods of conditioning and purifying the air in airplane cabins at high altitudes. The cabin is made of sheet metal and was especially built for the purpose . . . The Piccards first became intimately acquainted with the rarified air of the stratosphere in 1932 when Auguste Piccard ascended in a balloon to a height of 54,450 ft. (Photo courtesy Republic Steel Corp.)

PLANNING AIR CONDITIONING?



HERE'S THE SAFE, SURE, EASY WAY

THIS "Buffalo" CABINET

makes available to you in one compact, neat, scientifically designed unit everything from simple summer cooling to complete year 'round air conditioning.

It is equipped with those famously quiet high-efficiency Buffalo Fans, so essential to satisfactory air conditioning, especially where the utmost quiet is essential as in a large auditorium, a church, a school.

Heating and cooling coils are Aerofin, the heating coils being equally suitable to low or high pressure steam or hot water. (Full specifications are contained in Bulletin 501.)

Last but not least, these air conditioning cabinets are the result of as many years of research and experience in air conditioning work as has been had by any other manufacturer of similar equipment in the world. "See Your Consulting Engineer" before you buy air conditioning equipment. Let him give you the benefit of his impartial advice.

BUFFALO FORGE COMPANY

171 MORTIMER ST. *Branch Engineering Offices in Principal Cities* BUFFALO, N. Y.
In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Buffalo "P C" Cabinets maintain a comfortable, even temperature in this department store the year 'round.

Since the installation of Buffalo "P C" Cabinets in this sweets shop, patronage has increased and spoilage has been eliminated.

The Editor's Page

■ **A $1,000,000,000** volume before 1958 should be reached by the air conditioning industry if it follows its present rate of growth, according to Willis H. Carrier, Carrier Corp.'s board chairman, in an address last month before the seventh annual Connecticut sections meeting of the A. S. M. E. at Yale University. . . . Based on the trend prior to 1930, the billion dollar level would not be reached until 1958, he explained, but based on the trend since 1932 of the business to double every three years "a possible billion dollar annual business might be reached much sooner." . . . Taking into consideration rate of turnover of money and the return in the form of labor and salaries, Dr. Carrier held air conditioning may result in an $8,000,000,000 annual increase in national income. . . . Roger W. Babson has studied various new industries during the past three months, feels that "air conditioning offers the greatest opportunity" in that "it can directly or indirectly give millions of people jobs and go a long way toward restoring employment to normal conditions." . . . According to Mr. Babson, due to the demands for power from air conditioning, "there will be a shortage of generating capacity even after the new big government dams are in full operation. Some day, when air conditioning is universally used, the utilities will thank President Roosevelt for his foresight in providing this additional electric power." . . . Mr. Babson says that "less than one-tenth of one per cent of the office buildings, stores and factories in this country are air conditioned." . . . Sales of Carrier Corp. for this April were not only greater than April 1937 but, excepting March 1937, were the greatest of any month in the history of the business, L. R. Boulware, general manager, reports. April marks the first time since last September that a month's sales have gone ahead of the corresponding 30 day period of a year ago. . . . "In spite of the increase of this April over last," Mr. Boulware continues, "the first four months of 1938 were still very substantially behind the first four months of 1937, an unusual number of the large air conditioning projects having been booked in the first quarter of 1937. The sales for the first four months of 1938 were, however, 45 per cent ahead of those booked in the first four months of 1936." . . . Installed cost of equipment sold by the members of the Air Conditioning Manufacturers' Association in March was $5,419,116, an increase of 22 per cent over the February total of $4,428,469, and 68 per cent less than the March, 1937, figure of $17,137,869. "Sales have been on the steady upgrade since last December," William B. Henderson, A. C. M. A.'s executive vice-president, says. "We look for maintenance of this advance." . . . Air conditioning installations in use or under contract in Chicago passed the 2000 mark in April, says Commonwealth Edison Co. Seventy-three jobs were sold during the month, setting a new all-time high record for April and bringing the total number of plants in service or under contract to 2058. Sixty contracts were reported in April, 1937, and 39 in March of this year. . . . Capacity of installations sold this April was 817 hp, compared with 1044 hp in April, 1937, and with 596 hp in March, 1938. . . . Aggregate capacity of installations in use or under contract in Chicago at the end of April was 72,216 hp.

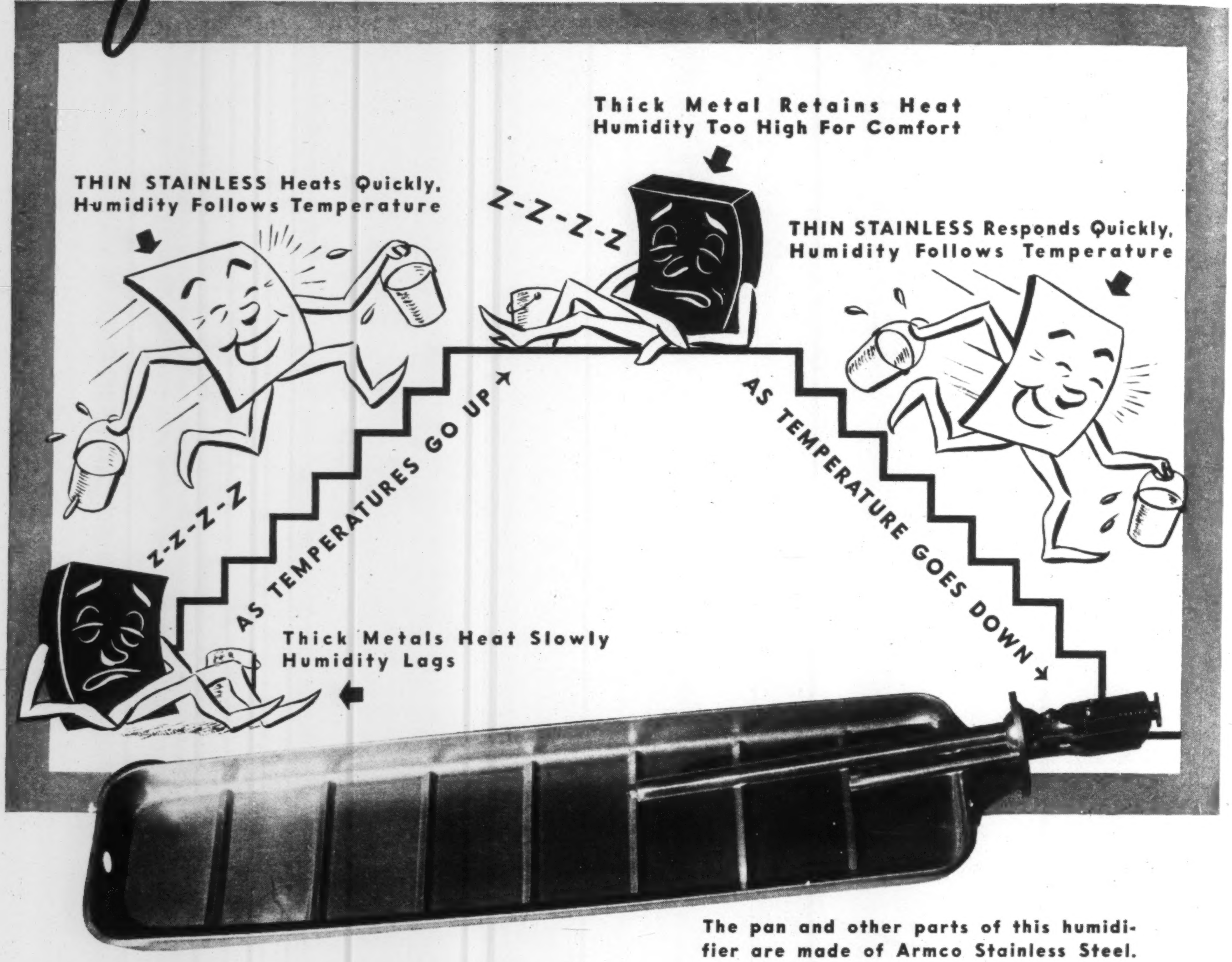
■ **The world's largest** diorama—a colored, lighted, animated architectural model of the New York metropolitan area—will be presented as their principal exhibit at the New York World's Fair 1939 by the Consolidated Edison Co. and affiliated companies. . . . More than 4000 buildings, studded with 130,000 windows, will be shown in the diorama, whose 204,000 watt illumination will require the most extensive model electric wiring job on record. Nearly a quarter mile of brilliantly colored neon tubing will represent the city's underground electric, gas and steam networks, while the most complete model subway system yet devised, with trains designed for a "World's Fair run" of 35,000 miles, will provide transportation highlights for the exhibit. Translucent generating station models will suggest the transformation of coal into electricity, gas and steam. . . . The model's length will be nearly that of a city block; its height will exceed that of a three story building. . . . It will be housed in a windowless, air conditioned exhibit building.

■ **Hospitals,** first air conditioned for operating rooms only, are extending the facilities because of the effects on patients suffering from hay fever, asthma, bronchial and lung conditions and heart disease, said Dr. A. G. Young, director of the Corey Hill hospital, Brookline, Mass., at the annual meeting of the Air Conditioning Manufacturers' Association last month. He stated there are 6000 hospitals in the U. S., 10,000 sanitariums. . . . William H. Price, Jr., Carrier Corp., was elected president of the A. C. M. A., J. J. Donovan, General Electric Co., was named vice-president, and P. A. McKittrick, Parks-Cramer Co., elected treasurer. New directors include the officers and P. Y. Danley, Westinghouse Electric & Mfg. Co.; J. M. Fernald, Baker Ice Machine Co.; J. A. Harlan, Nash-Kelvinator Co.; Frank Kirk, Vilter Mfg. Co.; S. E. Lauer, York Ice Machinery Corp.; J. F. G. Miller, B. F. Sturtevant Co.; and J J. Nance, Delco-Frigidaire Conditioning Div., General Motors.

■ **The Marley Co.,** makers of water cooling equipment for industrial and air conditioning applications, recently moved into their new building at Kansas City, Kansas, which houses the factory and warehouse on the first floor and national headquarters offices on the second. . . . An air conditioning system of 32 tons capacity serves the offices, with water cooling being provided by a cooling tower on the roof of the building. Gas fired unit heaters heat the factory floor and warehouse.

■ **The centers** of cities may be 14 F above the temperature of wooded or low countryside in quiet weather, it has been found by Rudolf Geiger of Munich, whose studies on "microclimates" are reviewed in the May "Industrial Bulletin" of Arthur D. Little, Inc. . . . Geiger found that on a hot day in Vienna the narrow streets were 10 deg cooler than the open boulevards.

DO YOUR HUMIDIFIERS SUFFER *from Metal Stupor?*


Thick Metal Retains Heat
Humidity Too High For Comfort
THIN STAINLESS Heats Quickly,
Humidity Follows Temperature
Z-Z-Z-Z
THIN STAINLESS Responds Quickly,
Humidity Follows Temperature
AS TEMPERATURES GO UP
AS TEMPERATURE GOES DOWN
Z-Z-Z-Z
Thick Metals Heat Slowly
Humidity Lags

The pan and other parts of this humidifier are made of Armco Stainless Steel.

You know how warm air comfort and efficiency depend on proper humidity. Metals previously used for humidifiers were "lazy," slow to heat or cool; but now all this has been changed for the better, thanks to Armco Stainless Steel.

The great strength, corrosion and heat resistance of stainless steel permit safe use of lighter gages. No longer must the metal be thick to meet severe service conditions. An Armco Stainless humidifier is more sensitive to temperature changes. It heats quickly when temperatures go up, charging the air with the right amount of moisture. When temperatures go down it also responds quickly and prevents over-saturation.

There is a correct grade of Armco Stainless for almost every type of furnace service. Use this durable metal for humidifier efficiency, for resistance to corrosion, scaling and loss of strength at elevated temperatures. We shall be glad to assist on special problems. Just write us. The American Rolling Mill Company, 2191 Curtis St., Middletown, Ohio. District Offices in all Key Cities.

ARMCO ARMCO **STAINLESS STEELS**

The Editor's Page

■ **Theater air conditioning** is surveyed in the current "Air Conditioning Trends" which is issued by the publisher of Heating, Piping and Air Conditioning. According to "Trends," 1500 theaters—10 per cent of the total available market—have been air conditioned since the first theater installations some 15 years ago. Of particular interest in the study reported is the fact that there appears to be decided activity in the field, especially among smaller neighborhood playhouses, both in suburban centers and the outlying sections of the larger cities. It is said that there is a definite trend of theater building in outlying sections as part of a general move to "bring the theater to its natural audience, rather than to force the audience to come to the theater." . . . According to "Trends" there were 16,251 theaters in operation in the United States the first of this year with a total seating capacity of 10,000,000; approximately 1500 of them now have air conditioning. . . . Other features of the current "Trends" are an analysis of the recent Department of Commerce report on city water and sewerage facilities in cities of 20,000 population and over, and an article on residential air conditioning and the need of consumer education.

■ **Design for Working** is the title of an attractive booklet issued by the Waverly Press, Inc., Baltimore, describing their new windowless, air conditioned building which was designed to be truly functional and to provide "inside working conditions which would rival a clear May day in the country—day and night, winter and summer." . . . The central station type air conditioning system maintains a temperature of 70 F and a relative humidity of 50 per cent during the winter under automatic control, and because the glass bricks are relatively warm on the inside—due to their insulation value—there is no condensation and little radiant body heat loss to the walls. In summer automatic controls on each floor maintain a 50 per cent relative humidity and a temperature 15 F cooler than the outside air, with a minimum of 80 F. . . . The cooling water for the 40 ton compressor is pumped to the roof where it is sprayed, cooled and used over again. According to the Waverly Press this not only saves $500 annually in water cost, but keeps the roof cool, lengthens its life, and reduces heat gain of the building.

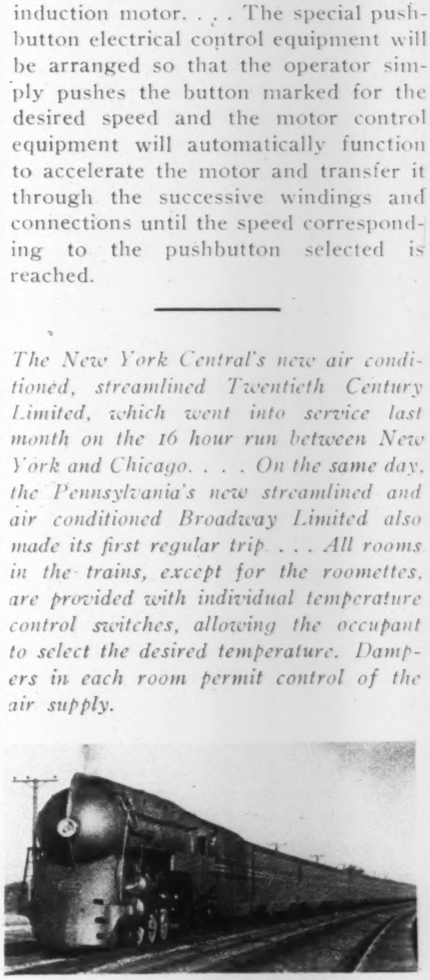
■ **Fuel Oils**—Revised tentative specifications for fuel oils and a new tentative method of test for sediment in fuel oil by extraction have been issued by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., and approved by the society's committee on standards on the recommendation of the committee on petroleum products and lubricants. . . . The specifications for fuel oil were issued for the first time as tentative in 1934. Since then a number of suggestions for improvements have been received and have been under consideration for some time. The specifications as now revised will, in the opinion of the committee, fit present-day needs better than those originally issued. . . . The new specification provides for five grades of oil instead of six as in the old requirements. Certain changes in the methods of testing have been incorporated, including for Grade No. 6 the use of the new test for sediment in fuel oil by extraction (D 473—38T) which is based upon the methods used by the Federal Specifications Board for many years. . . . Copies of the revised fuel oil specifications and the new test for sediment can be obtained in separate pamphlet form from A.S.T.M. headquarters at 25 cents each.

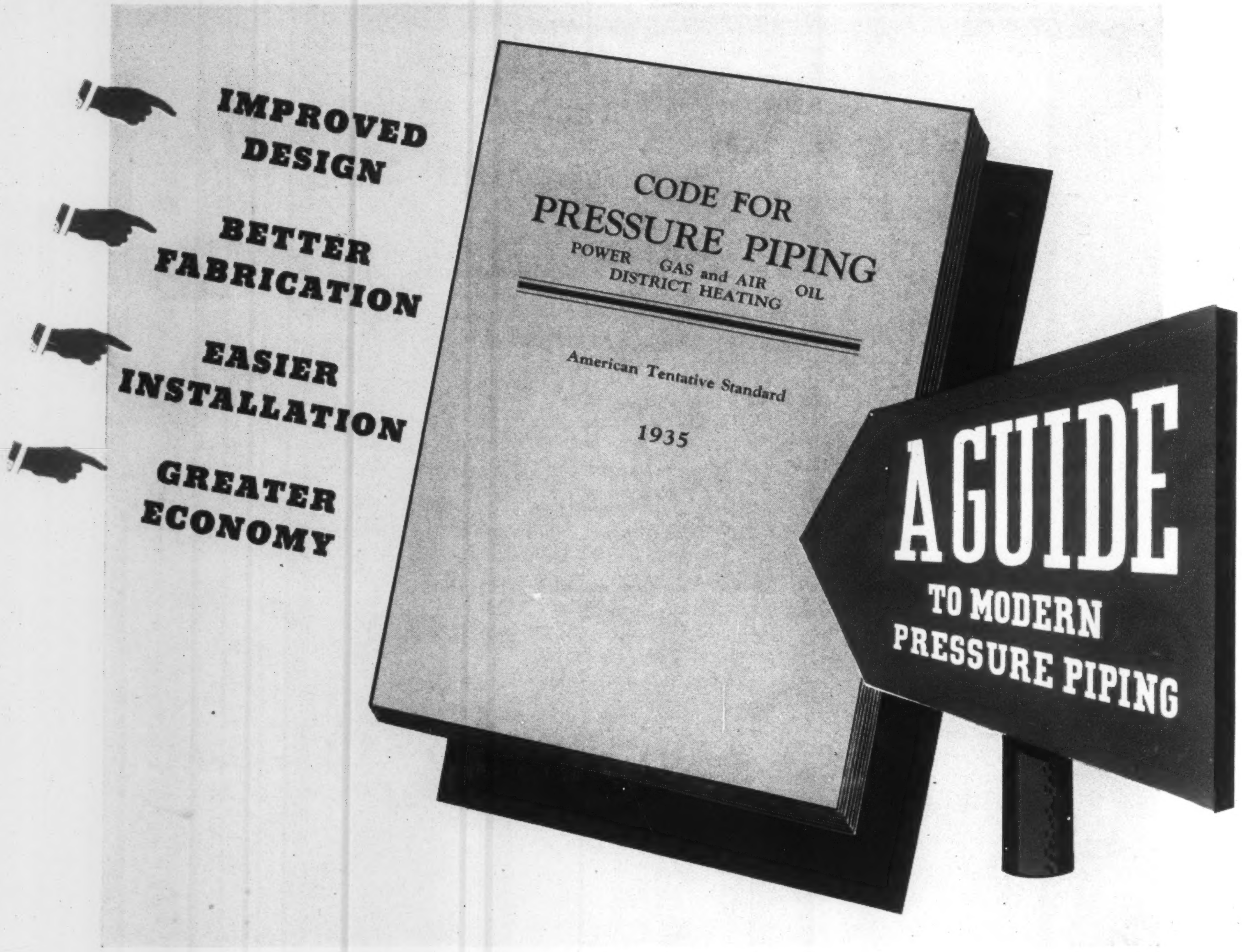
■ **An interesting** section of the "Koppers Yearbook," just published by the 24 year old Koppers Co., shows total company figures for 1937 divided as if each of its 10,029 employees were in business for himself with his proportionate share of the company's capital, sales, operating expense and payroll. . . . The working capital of each individual, provided by himself or borrowed, would be $11,493. He would sell products, render services and receive investment returns totaling $6,685. Of this he would spend $4,181 for raw materials, power and manufacturing supplies, freight and other operating expenses. His tax bill would be $181. He would have $178 for plant and machinery replacement, to meet immediate or later requirements. His share for wages paid to himself for carrying on his business for one year would be $1,561. There would be $584 remaining to pay interest on his investment and on the money he borrowed, as well as to provide for expansion of his business.

■ **The Stoker** Manufacturers' Association, meeting at Hot Springs, Va., last month, elected E. C. Sammons, vice-president, Iron Fireman Mfg. Co., Portland, Ore., president. Frank Hoke, vice-president, Holcomb & Hoke Mfg. Co., Indianapolis, was elected vice-president. G. Walter Ostrand, manager, Caldwell-Moore Plant, Link-Belt Co., Chicago, was re-elected treasurer.

■ **Electrical equipment** involving a large four speed motor is being built by Westinghouse for the new wind tunnel for Massachusetts Institute of Technology. This equipment will drive the wind tunnel fan. . . . The motor is rated at 2000/1080/343/170 hp, 1180/880/585/443 rpm, and is a four speed, two winding, squirrel cage type induction motor. . . . The special pushbutton electrical control equipment will be arranged so that the operator simply pushes the button marked for the desired speed and the motor control equipment will automatically function to accelerate the motor and transfer it through the successive windings and connections until the speed corresponding to the pushbutton selected is reached.

The New York Central's new air conditioned, streamlined Twentieth Century Limited, which went into service last month on the 16 hour run between New York and Chicago. . . . On the same day, the Pennsylvania's new streamlined and air conditioned Broadway Limited also made its first regular trip . . . All rooms in the trains, except for the roomettes, are provided with individual temperature control switches, allowing the occupant to select the desired temperature. Dampers in each room permit control of the air supply.




IMPROVED DESIGN
BETTER FABRICATION
EASIER INSTALLATION
GREATER ECONOMY
CODE FOR PRESSURE PIPING
POWER GAS and AIR OIL
DISTRICT HEATING
American Tentative Standard
1935
A GUIDE
TO MODERN PRESSURE PIPING

Sponsored by the American Society of Mechanical Engineers and approved by the American Standards Association, this Code is invaluable to anyone concerned with pressure piping.

It contains 150 pages of authentic information on the selection of suitable materials . . . indicates the proper dimensional standards . . . lists the maximum allowable stresses in materials, etc. Considerable space is also devoted to fabrication details such as: hangers, flange joints, welded joints, welding procedure, etc.

Qualified pipe fabricators use this Code as a standard guide for economically fabricating products that facilitate erection and reduce installation and maintenance costs.

The Pipe Fabrication Institute will forward on request a copy of the Code for Pressure Piping at the established price of $1.00 per copy.

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The Editor's Page

■ **The benefits of air conditioning** in increasing human efficiency and health in industry need greater emphasis, W. H. Carrier told the American Conference of Industrial Physicians and Surgeons recently when he spoke on air conditioning in relation to industrial hygiene. The air conditioning engineer welcomes any assistance, said Mr. Carrier, that the medical profession can give on the important subject of optimum summer temperatures with relation to outside conditions of temperature and humidity. The engineer can produce any condition within reason or desire and can determine statistically what conditions produce optimum comfort to the occupants of a building under varying conditions. He does not, however, pretend to be competent enough to measure the beneficial or unfavorable effects of such temperatures and for this he must rely on the medical profession. . . . Mr. Carrier's address covered principles of industrial air conditioning, difference between industrial applications and air conditioning for human comfort, reconciliation of industrial and hygienic requirements, acclimatization, and how air conditioning improves human efficiency. He cited a number of cases indicating the efficiency and health benefits of industrial air conditioning installations, among which were the following:

(1) Under one management in Virginia there were, side by side, an old cotton mill and a new air conditioned mill. Improvement in working conditions in the new mill was so great that it was a real inducement to workers. There was always a waiting list of applicants from which the most skilled and efficient workers could be selected. Obviously this condition greatly improved the efficiency of this particular mill apart from the gain due to the better processing of the product.

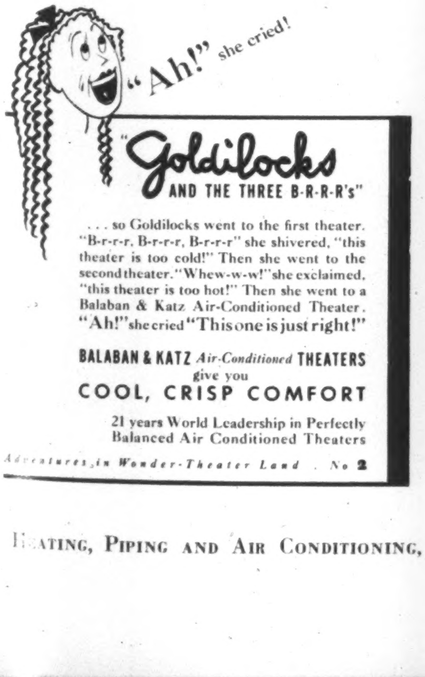
(2) Prior to air conditioning, tobacco stemming rooms had never been humidified. Not only was there a loss from the breakage of the leaf in process but the dust conditions were terrible. Air conditioning was installed to remove the dust through high humidities and rapid air change. As a result, the room was clear and operatives could work in it without any discomfort or ill effects; moreover, loss by breakage was sufficiently reduced to pay for the installation. Not only was the air in this room freed from dust but it was comfortably cooled in summer, so much so that workmen from other parts of the factory went into this room to eat their lunch on hot days. This is an excellent example of combining benefits to the product with improved hygienic conditions for the operative.

(3) The medical statistics in connection with the air conditioning of the Robinson Deep gold mine are most interesting. The same company operates two separate shafts, the Turf shaft where the cooling plant is installed and the Chris shaft which has no cooling plant. Each shaft has its own compound where the native labor force is housed. Their medical report states: "There has been a slight increase in the incidence of pneumonia at the main compound where the Chris labor force is housed but in the Turf compound the incidence dropped from 58.4 per thousand during 1935 to 34.4 per thousand in 1936." This is a decrease of over 40 per cent in the incidence of pneumonia as compared with former records.

(4) In industries involving high temperatures (such as steel rolling mills, for example) it would be impossible to operate in semi-tropical climates during a considerable portion of the year without the art of air conditioning. A good example of this is the Tata Steel Co. in India, the largest steel plant in the British empire. The operations in this plant were necessarily shut down during the hot monsoon season but by the aid of air conditioning they were able to operate continuously. Here large volumes of air are drawn through humidifiers where the air is saturated and cooled to the wet bulb temperature, usually dropping the outside air temperature from 105 to between 70 and 75 deg purely by evaporative cooling.

(5) Under adverse conditions at the Moro Velho gold mine in Brazil, 20 fatal accidents occurred in 16 months prior to the installation of a refrigerating and air conditioning system, when the effective temperature in the mine averaged 90½ deg. During the 16 months after the installation of the equipment, only six accidents occurred, owing to improved working conditions, and output improved 13 per cent.

Air conditions that are "not too cold and not too hot" were advertised this way last month in newspaper movie pages by the Balaban & Katz theaters of Chicago.


"Ah!" she cried!

"Goldilocks AND THE THREE B-R-R-R's"

. . . so Goldilocks went to the first theater. "B-r-r-r, B-r-r-r, B-r-r-r" she shivered, "this theater is too cold!" Then she went to the second theater. "Whew-w-w!" she exclaimed, "this theater is too hot!" Then she went to a Balaban & Katz Air-Conditioned Theater. "Ah!" she cried "This one is just right!"

BALABAN & KATZ *Air-Conditioned* THEATERS
give you
COOL, CRISP COMFORT

21 years World Leadership in Perfectly Balanced Air Conditioned Theaters

Adventures in Wonder-Theater Land . No 2

■ **Present-day** high steam pressures have intensified trap problems; the practice followed in dripping steam piping may differ greatly depending upon methods of plant operation, pressure and temperature conditions, arrangement of the steam lines, etc. . . . In the May, 1938, H. P. & A. C. an article entitled "Drips and Drains for High Pressure Piping" described the general practice of one engineering office. . . . Arthur McCutchan's article, published this month, describes different methods of approaching the problem—comprising principally use of either orifices or impulse type traps, and socket welded construction.

■ **Neiler, Rich & Co.**, Chicago, professional consulting engineers, celebrated last month their 44th anniversary. According to Samuel G. Neiler, operating head of the company, the firm has a number of important engineering projects under way at the present time.

■ **Meteorologists** and air conditioning engineers have one thing in common—both seek to forecast the weather, Anson D. Marston told the members of the American Meteorological Society at their recent meeting. The meteorologist makes a business of forecasting the weather as it will be outdoors; the air conditioning engineer makes a business of forecasting the weather as it will be inside of some enclosure. . . . Mr. Marston reviewed studies on establishing a degree day base for cooling and said that 65 deg appears to be correct for commercial customers; for residential customers, the base appears to be either 68 or 70 F. . . . His studies were reported in detail at the 1937 semi-annual meeting of the A.S.H.V.E. and published in the A.S.H.V.E. Journal Section of Heating, Piping and Air Conditioning, August, 1937.

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ONE of the big advantages in "standardizing on Tube-Turns" is that the complete Tube-Turn line is stocked by distributors in every key city in the country. In addition to carrying Tube-Turns themselves (in 45°, 90° and 180° types), these distributors also stock Tube-Turn tees, reducers, heads, lap-joint nipples and forged steel flanges. . . . The same features of uniformity, accuracy and strength that make Tube-Turns the first choice of thoughtful users everywhere are characteristic of all other fittings in the Tube-Turn line. . . . The Tube-Turn distributor in *your* section is equipped to serve you. May we give you his name and address? *Write* to: Tube-Turns, Incorporated, Louisville, Ky.

The word "Tube-Turn" is NOT a necessary general trade name for welding fittings. It is the registered trade-mark for the products made by Tube-Turns, Incorporated, under their patents.

The Editor's Page

Housing—The $800,000,000 slum clearance and low rent rehousing program now going forward under direction of the United States Housing Authority is of such a decentralized nature that sole responsibility for initiating, letting of contracts, constructing and managing the projects rests on the shoulders of the local housing authority in the locality where the development is built. Contractors who are successful in bidding on any low rent rehousing project will be responsible only to the local housing authority which, in every case, will award all contracts.

Nathan Straus, USHA Administrator, emphasized in a recent release that while the Authority retains a certain degree of supervision over local authorities in the development of housing projects from the acquisition of land to the selection of tenants, this will not extend beyond the limits needed to assure compliance with the details of both the Housing Act and the loan contract under which the USHA lends the local housing authority 90 per cent of the total development cost of the low rental rehousing project. At no time should this supervision lead to additional costs which might be reflected in higher bids by contractors.

In the interest of cooperation between the federal and local agencies, Administrator Straus has designated a USHA Construction Adviser to act in a purely advisory capacity and render advice and suggestions to the local authority on the site of each housing project. But the Adviser is specifically prohibited at all times from giving orders to the contractor. While the USHA will review the plans and specifications for the project and furnish technical assistance, responsibility for design and specifications and for observance of all the loan contract requirements rests with the local housing authority.

At the same time, while the USHA is permitted to observe and review all work, materials, payrolls and other relevant records and data, all instructions and approvals with respect to the work shall be given to the contractor only by the local authority or the architect.

Under the policy of the USHA, all work will be performed on a "Fixed Price Contract" basis. In addition the USHA recommends that local housing authorities divide their projects into several sections, in order that bids may be made on each section in addition to the entire contract. This will enable smaller contractors, who would be unable to undertake such mammoth developments as are most low rent housing projects under the program, to bid on a part of the contract, thereby encouraging wider competition among several bidders.

Under the recommended procedures, it is expected by the USHA that contractors should experience no more difficulty in preparing their bids and performing work under their contracts for low rent housing projects than they would encounter in bidding and working on a private contract of similar size.

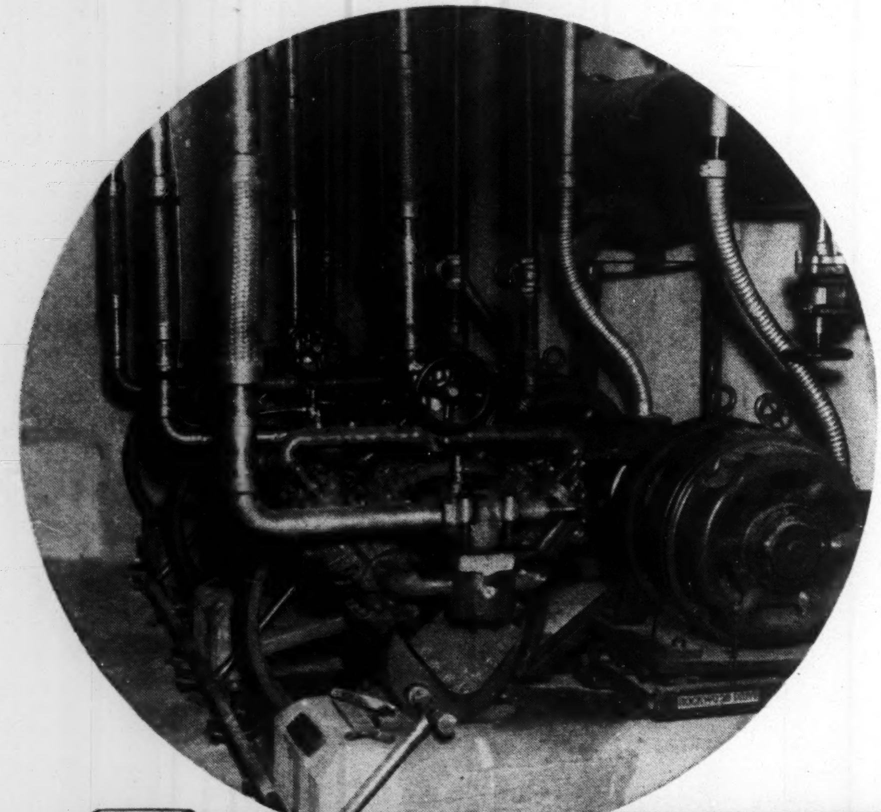
Humiture is the word coined by Osborn Fort Hevener to designate an index combining temperature and relative humidity. The two figures are added, and then divided by two for the humiture value; for instance, if the temperature is 82 and the relative humidity 76, the humiture is 79. . . . Mr. Hevener has long followed Frank L. Baldwin's weather column in the Newark, N. J., Evening News and several months ago submitted his idea to Mr. Baldwin. Recently the new word has been given national publicity. . . . Mr. Hevener realizes there are objections to adding unlike quantities such as degrees Fahrenheit and per cent relative humidity, but feels his index gives the "man on the street" a fairly accurate idea of the combined effect of the two factors involved.

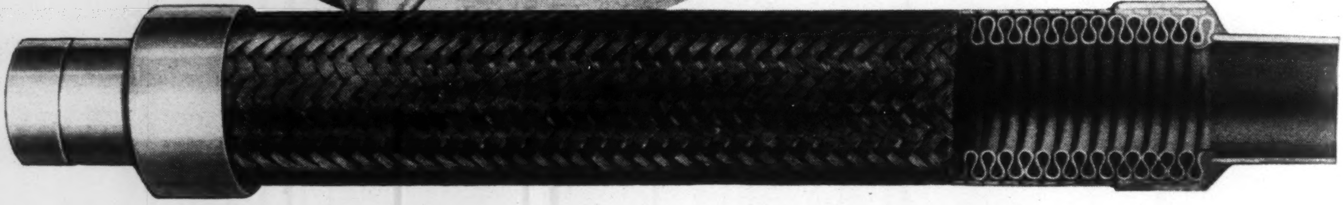
A replica of a "Pennsylvanian Fireplace," Benjamin Franklin's first important invention, is on display at the Franklin Institute at Philadelphia, where it attracts wide attention. While the fireplace did not bring Franklin as much fame as he received from his later achievements in the field of electricity, it was recognized as a revolutionary improvement in heating and added substantially to his prestige. . . . His fireplace is in reality a cast iron stove designed to be installed in an open fireplace. Its installation requires the construction of a false back of brickwork four inches or more from the true back and the closing of the space over the fireplace between the false back and the breast of the chimney. Thus the heated air is prevented from going up the chimney, while the smoke is conveyed thither through a passage under the false back. Through this invention Franklin not only kept smoke out of many colonial eyes, but also added greatly to indoor comfort, as his fireplace distributed its warmth more generally throughout the room, so that people were not forced to crowd around the fire and be "scorcht before, and, as it were, froze behind," as he expressed it.

Orchestra Hall, the Michigan Boulevard headquarters of Chicago's symphony orchestra, is installing air conditioning and expects to have the system in operation for the coming season. The new plant is an air washer job with a capacity of 190 tons and handling 70,000 cfm. Object is to make the auditorium usable the year around. . . . Several years ago an attempt was made to condition the building with an air washer installation without refrigeration; however, the water was not cool enough to improve conditions. . . . L. H. Prentice Co. are the contractors for the new installation.

More than 230 manufacturers have engaged exhibit space for the thirteenth National Exposition of Power and Mechanical Engineering to be held at the Grand Central Palace in New York City, December 5-10. . . . The affair is to be under the management of the International Exposition Co. with President Charles F. Roth in charge.

Time Capsule—Within the next few weeks the Westinghouse Electric and Mfg. Co. will deposit on the grounds of the New York World's Fair 1939 a "Time Capsule" containing a "cross-section of our times" with the expectation that it will be recovered by archaeologists 5000 years from now. . . . . Simultaneously with its deposit, the leading libraries, museums and repositories of the world will receive a finely bound and printed book telling future archaeologists where the capsule lies, what is in it, and how to locate and recover it. . . . The country's foremost engineers, metallurgists, archaeologists, historians, scientists, scholars and the public in general are being consulted to make the project "truly representative of our time."





American Vibration Eliminators in suction lines of new commercial air-conditioning system installed in the Roger Sherman Theatre (a Warner Bros. Theatre). New Haven, Connecticut. The eliminators absorb undesirable noise and vibration.

Below is a cut-away view showing Seamless Flexible Bronze Tubing covered with bronze wire braid. The welded fittings slip over copper tube or into solder fittings.

You Dampen Vibration and Deaden Noise with AMERICAN VIBRATION ELIMINATORS

THE twin problem of noise and vibration is easily and effectively solved with American Vibration Eliminators. Made of seamless flexible bronze tubing, their *flexibility* readily isolates compressor vibration and prevents the transmission of noise along rigid pipe lines; being *seamless,* they are seep-proof; made of true *bronze,* they are highly resistant to such common refrigerants as freon and methyl chloride.

American Vibration Eliminators have stood the test of service on thousands of installations. Leading air conditioning manufacturers are using them as standard parts on their machinery. These eliminators in sizes up to 3″ I. D. are obtainable to fit *over* copper water tube or *into* solder fittings. Thoroughly cleaned, they are end-sealed with moisture-proof, dirt-proof caps. Stocked by leading jobbers. *Write for free descriptive bulletin VE-2.* 38345

American Metal Hose

ANACONDA from mine to consumer

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Connecticut • Subsidiary of Anaconda Copper Mining Company

The Editor's Page

■ **Savings to industry** by arc welding claimed by authors of papers submitted in the $200,000 award program of the James F. Lincoln Arc Welding Foundation aggregate $1,600,000,000, according to the central committee of the jury of award which arrived at this figure after discounting some very enthusiastic claims. . . . Three hundred and eighty-two awards were made by the foundation and announced last month. . . . In the containers classification covering piping, R. C. Doremus, refrigerating engineer, George B. Bright Co., and a member of H.P.&A.C.'s Board of Consulting and Contributing Editors, received an award for his paper on modernizing a large brewery with arc welded piping; Eric Seabloom, research welding engineer, Crane Co., received an award for his paper on eliminating flange joints on high pressure piping; Howard Weiss, engineer, Dingle Clark Co., received an award for his paper on a steel mill pipe line, and Sumner E. Perkins, chief mechanical engineer, Flintkote Co., received an award for his discussion of welded pipe lines for paper board cylinder machines. . . . The grand award of the foundation's program went to Mr. and Mrs. A. E. Gibson of the Wellman Engineering Co. for their treatise on the elements required to insure the business and technical success of users of welding.

■ **The "Flat Foot Floogee,"** more than 100 objects in common use today, more than 10,000,000 words and 1000 pictures in a microfilm "essay on civilization," and a 15 minute newsreel were buried in a "Time Capsule" 50 ft beneath the New York world's fair site September 23, which was marked to be opened 5000 years from now. The objects—intended to give a record of our time for the information of posterity 5000 years hence—were carefully packed in a nitrogen filled inner glass crypt which was wrapped in glass tape and inserted in the 7½ ft by 8 in. copper alloy capsule. . . . During the fair, the capsule may be on view through a periscope, and inside the Westinghouse exhibit building will be a replica together with duplicates of all the objects, books, fabrics, alloys, toys, newsreels, and other items it contains. When the fair is over, pitch and concrete will be poured down the periscope well, the retaining pipe will be removed, and the capsule will be left for discovery by archaeologists of the future.

■ **Twice as much** air conditioning has already been planned for by exhibitors at the New York world's fair next year as was in use at the Century of Progress exposition in Chicago four years ago. According to W. B. Henderson, executive vice-president of the Air Conditioning Manufacturers' Association, the Chicago exposition with approximately 750 tons of refrigerating capacity operating in its air conditioning systems did more to familiarize the general public with the comforts of air conditioning than any other single event in the history of the industry. . . . Installations already reported for the New York fair will require over 1500 tons and will be provided primarily for the comfort of visitors, although several exhibitors will also employ it for their model manufacturing and food processing plants. . . . Among the more unusual installations will be that in the Carrier Corp.'s exhibit building which is to take the form of a giant igloo towering higher than a five story building, and with "snow" encrusted walls and the Northern Lights playing from its ceiling. The purpose of the exhibit will be to take visitors behind the scenes of air conditioning and bring them down through the 37 years of successful developments since 1902 when Mr. Carrier made his first air conditioning installation in a Brooklyn lithography plant.

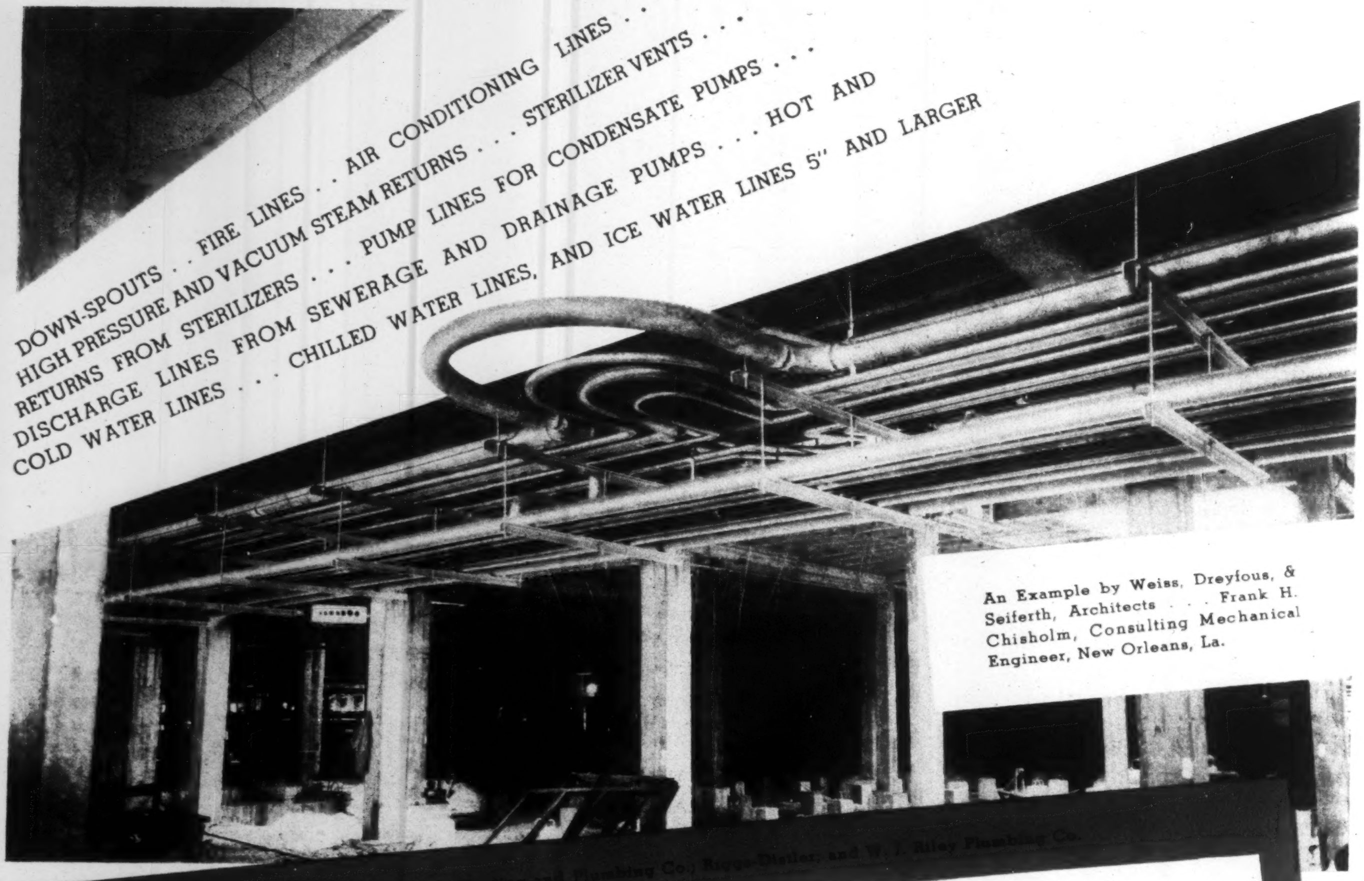
To suggest how well the "Time Capsule" buried last month beneath the site of the New York world's fair can withstand unusual conditions, Westinghouse' Dr. Harvey C. Rentschler pours intensely cold liquid air over it. . . . The alloy of which the tube is made is composed of copper, chromium and silver and was selected by research engineers as the most practicable means of delivering intact the visual record of the present day. The alloy is used in industry as welding electrodes, welding tips, and in other tasks where high conductivity and heat resistance are essential qualities.

■ **Buy air conditioning** through your architect — engineer — contractor, was the message born by the air conditioned plane in which J. Smith Ferebee flew across the continent last month on the "golf marathon to end all golf marathons." His wager agreement with one of his business associates called for 600 holes of golf to be played between Los Angeles and New York within four days, or more than 72 holes at Los Angeles, Phoenix, Kansas City, St. Louis, Milwaukee, Chicago, Philadelphia, with the wind-up at New York; he completed his stunt successfully September 28. . . . The 14 passenger plane was air conditioned by Reuben N. Trane, head of the Trane Co. At the various stops special arrangements were made to emphasize the theme of the message and to give local architects, engineers and heating contractors an opportunity to see Mr. Ferebee play.

■ **Shall the term** "calorific value" be used to indicate the heating value of a fuel, or shall some other term such as "heat of combustion" be used as the standard? is one of the questions facing an American Society for Testing Materials committee on nomenclature and definitions. A subcommittee assigned to the selection of the standard has found a number of different terms now in use, among which are calorific value (because a calorimeter is used in determining the heating value of a fuel), Btu value (because results have frequently been reported in terms of the British thermal unit), thermal value, and heating value. The subcommittee inclines toward "calorific value," according to the A.S.T.M. *Bulletin*, because of its wide acceptance internationally as well as nationally. . . . Anyone having a definite opinion on the question should write H. C. Porter, care of the A.S.T.M. at 260 S. Broad St., Philadelphia, Pa.

Where Corrosion Threatens—Experience Suggests

WROUGHT IRON


DOWN-SPOUTS . . FIRE LINES . . AIR CONDITIONING LINES . .
HIGH PRESSURE AND VACUUM STEAM RETURNS . . . STERILIZER VENTS . . .
RETURNS FROM STERILIZERS . . . PUMP LINES FOR CONDENSATE PUMPS . . .
DISCHARGE LINES FROM SEWERAGE AND DRAINAGE PUMPS . . . HOT AND
COLD WATER LINES . . . CHILLED WATER LINES, AND ICE WATER LINES 5" AND LARGER

An Example by Weiss, Dreyfous, & Seiferth, Architects . . . Frank H. Chisholm, Consulting Mechanical Engineer, New Orleans, La.

Contractors: The American Heating and Plumbing Co.; Riggs-Distler; and W. J. Riley Plumbing Co.

In the Charity Hospital at New Orleans, an extra factor of dependability and safety was added by the use of Wrought Iron in vulnerable services. In addition to the applications indicated, over 8000 lbs. of wrought iron flats and bars were used.

The difficult job of selecting proper materials to meet corrosive conditions has been simplified for many architects and engineers through our corrosion clinic. If you will write, outlining your problem, our Engineering Service Department will (1) Determine the probable corrosive conditions. (2) Relate these to kindred conditions existing elsewhere. (3) Interpret the results in terms of experience gained in three quarters of a century of contact with corrosion problems . . . and (4) Confirm the recommendations with actual service records.

Do you have the bulletin "Wrought Iron for Piping Systems"? Ask for it. A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

Specify Byers Genuine Wrought Iron Pipe for corrosive services and Byers Steel Pipe for your other requirements.

BYERS
GENUINE
WROUGHT IRON
Tubular and Flat Rolled Products

The Editor's Page

■ **Air conditioning** for human occupancy is the general subject for discussion at a symposium on air conditioning to be held in the Engineering building, Chicago, starting at 7:30 p.m., November 22. The meeting is sponsored by the Chicago chapter of the American Institute of Architects, the Illinois Society of Architects, the Western Society of Engineers, the Illinois chapter of the American Society of Heating and Ventilating Engineers, the Chicago Association of Consulting Engineers, the Refrigerating Machinery Association, and the Air Conditioning Manufacturers Association. John Howatt, past president of the A.S.H.V.E., chief engineer of the Chicago Board of Education and member of H.P.&A.C.'s Board of Consulting and Contributing Editors, will be the presiding officer. . . The speakers are to be Prof. Philip Drinker, Charles S. Leopold (both of whom are members of H.P.&A.C.'s Board of Consulting and Contributing Editors), W. H. Carrier, Albert Buenger, Elliott Harrington, John R. Hertzler and William B. Henderson.

■ **The "world's largest"** weather vane—72 ft long, made of stainless steel, and mounted on a 110 ft copper mast—will direct attention to the American Radiator & Standard Sanitary Corp. building at the New York World's Fair next year, according to plans announced last month. The building will be unique in that it will use as decoration the common materials of the heating and plumbing industries. . . The purpose of the exhibit will bring home to Fair visitors the possibilities which exist today for greatly improved standards of health, comfort and convenience. Animated displays will tell the story of heating, ventilating and air conditioning.

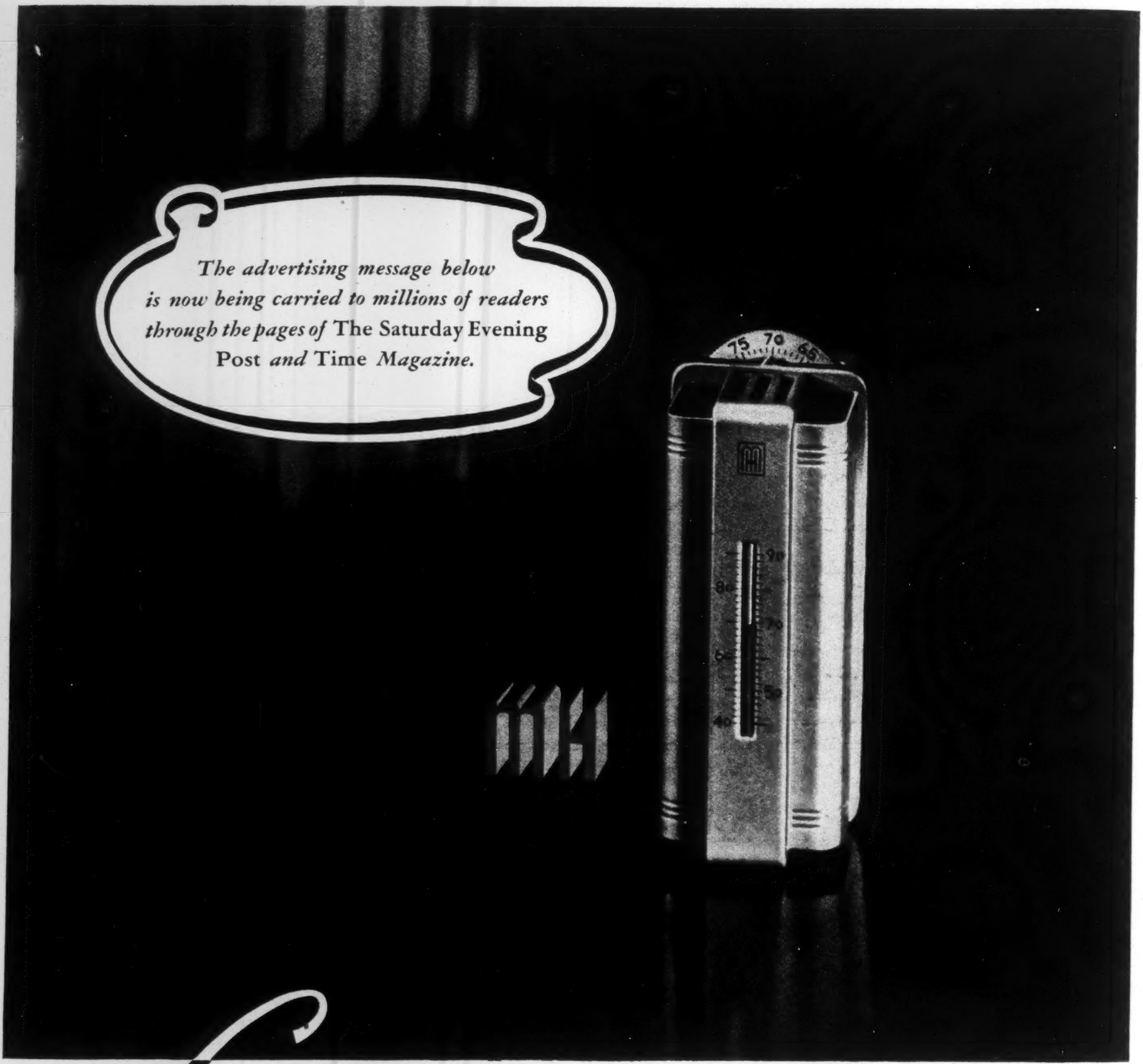
■ **Coscos tatti** have been the means in India for ages past to furnish a form of air conditioning that is effectual though primitive, according to J. A. Dooley, manager of the refrigeration department of the International General Electric Co., Ltd., Bombay. The instruments of comfort bearing this strange name are window screens of woven grasses over which water is sloshed at regular intervals. They provide evaporative cooling, and add a delicate fragrance to the air; as the water evaporates from the screens it cools the air and releases the scent of the grasses which—says Mr. Dooley—is like the sweet smell of the earth after an early summer rain. . . Prevailing winds and breezes take the place of fans in providing ventilation and sufficient air for evaporation, and consequently only rooms on the windward side of the house can be cooled. Furthermore, the atmosphere must be dry if there is to be sufficient evaporation for cooling, and the system will not work therefore in the hot, moist cities. . . In older times, slaves poured buckets of water on the screens, but this has given way to an automatic system consisting of a trough at the top of the screen. Water runs slowly into the trough, and when it is filled to a given point, it becomes overbalanced and dumps its load over the screen. Counterweights bring the trough back to its original position ready to be filled.

■ **Heating and** ventilating equipment valued at $7,100,000 was among the nearly $700,000,000 worth of materials purchased for projects of the Works Progress Administration during its first three years through June 30, 1938, according to U. S. Treasury and WPA statistical reports. All purchases for federal account were made through the procurement division of the treasury after open competitive bidding. . . The figures indicate a considerable step-up in the purchase of heating and ventilating equipment, since comparative figures at the end of August, 1937, after the WPA had been operating for 26 months, showed purchases of $4,797,069. The monthly average since that time has been $230,295.

■ **For some time** Committee A-1 of the American Society for Testing Materials has been developing standardized requirements for spiral welded pipe and there has now been issued a new specification (A 211—38 T) covering spiral welded steel or iron pipe 4 in. to 48 in. in diameter, inclusive, with wall thickness from $\frac{1}{16}$ to $\frac{11}{64}$ in., manufactured by the following electric fusion welded processes: spiral lap welded joint, spiral lock seam welded joint, or spiral butt welded joint. . . In order to cover spiral welded material greater than $\frac{3}{16}$ in. in thickness, tentative revisions are being published in two existing specifications covering electric fusion welded steel pipe of sizes from 8 in. to 30 in., and sizes 30 in. and over.

■ **The public schools** of Chicago are described and illustrated in an attractive 98-page booklet prepared under the direction of John Howatt, chief engineer of the school system and member of H.P.&A.C.'s Board of Consulting and Contributing Editors, for presentation to those attending the annual convention of the National Association of Public School Business Officials held last month. Of particular interest is the section on the bureau of engineering, describing the operation and supervision of the school plants, the personnel, and mechanical facilities. In this section purchase and testing of fuel is discussed, and curves of coal consumption in net pounds burned per thousand cubic feet of heated and ventilated building volume per degree day show substantial reductions during the past few years for both high and elementary schools. . . It is pointed out in describing the heating and ventilating equipment of the schools that to meet the requirement of ordinances means the continuous introduction and distribution of approximately 15,000,000 cu ft of outdoor air every minute of every school day in the city schools. This large volume of air is cleaned by filters or air washers in the more congested sections and is humidified everywhere to provide a relative humidity of 40 per cent in the classrooms, or in extremely cold weather until moisture forms on the windows. . . The largest boiler plant in the system is that for the Normal School group of buildings and consists of six 450 hp water tube high pressure boilers. There are 833 boilers in the schools which total 134,272 hp, of which 770 are high pressure boilers and 63 are low pressure boilers.

■ **Reconstruction** and modernization of Bridgeport Brass Co.'s pipe and tube mill at Bridgeport, Conn., as the next step in a long range program undertaken to improve all manufacturing facilities, was started last month, according to an announcement from the company. . . Additional tube mill equipment will be installed and the entire operation of this division of the company will be broadened through the utilization of space vacated by the moving of rolling mill equipment to the new $4,500,000 rolling mill previously completed.



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Comfort Marches On . . . The smartly styled Acratherm and its identifying "M-H" monogram, symbolize improvements in all types of automatic heating which have brought to home owners an experience in winter comfort undreamed of even a few short years ago. More than a thermostat, the Acratherm is visible evidence of the seldom seen "M-H" control system, which actually makes automatic heating automatic. Your dealer can and will supply complete Minneapolis-Honeywell Controls with his equipment. Look for the "M-H" Symbol . . . It is your assurance of lasting, carefree heating comfort.

MINNEAPOLIS-HONEYWELL

BROWN INDUSTRIAL INSTRUMENTS · NATIONAL PNEUMATIC CONTROLS
MINNEAPOLIS-HONEYWELL REGULATOR COMPANY . . . MINNEAPOLIS, MINN.

Control Systems

The Editor's Page

■ **Work is under way** on Heating, Piping and Air Conditioning's fifth annual directory number, which you will receive—in a special container—next month. It will feature a completely revised listing of every product and accessory used in industrial and commercial heating, piping and air conditioning work classified by products; a complete listing of trade names; and the addresses of all manufacturers. . . . . Rounding out your copy of the January issue will be the regular monthly quota of outstanding technical articles and departments, as well as the Journal Section of the American Society of Heating and Ventilating Engineers.

■ **"We have a wonderful** future ahead of us in any line of business today if we will just lift the lid and say we know so little about anything." This was the keynote of the address of Charles F. Kettering, vice-president of General Motors in charge of research, at a luncheon given in New York City last month. "We are just learning about steel," stated Mr. Kettering. "We are just learning about rubber, we are just learning about oil; and the reason I have taken a little time on the subject of a growing plant is that that is the place where the sun contacts the earth, and some of its energies stay and we need to know how it is done. The greatest receiving set is the leaf of a plant, and if it wasn't for that leaf of a plant, you wouldn't be here, you wouldn't have automobiles or anything else, and yet today in this age in which we call ourselves scientific, we know just exactly nothing about how the leaf of a plant is able to pick up the radiant energy from the sun and convert it into new chemical compounds. . . . You know we hear a great deal about technology unemployment and technological development. Because I have been in that business all my life I can speak freely without hurting my own feelings. We have today a very unusual condition in this country where we have an excess of materials, excess of money and excess of men. Now, all that that can mean to a primitive mind like mine is that we haven't got any projects. That is all. Which means that we are technologically behind and not technologically ahead, and if you could get this idea that we know very much about anything out of our minds, and that the whole thing is ahead of us, then I think we would have a shortage of labor in a short time. People right away would say, 'What are you going to do?' . . . I don't know. Any place you pick up you could start, because we don't know very much about anything, and I have come to the conclusion that a scientific fellow is a fellow who doesn't know what he is working on and is afraid to admit it."

■ **Refrigerating equipment** standards have just been published by the Refrigerating Machinery Association, Southern Bldg., Washington, D. C., according to an announcement. These equipment standards represent the first of a series to result from the broad standardization program which the association initiated a year or so ago. . . Part 1 of the standards deals with ammonia equipment under the following headings: Enclosed ammonia compressors, vertical open shell and tube ammonia condensers, horizontal closed shell and tube ammonia condensers, horizontal closed ammonia shell and tube brine coolers (flooded), submerged open ammonia brine coolers, ammonia liquid receivers, ammonia mains, steel and wrought iron pipe, and cold storage room insulation. . . Part 2 covers the results of the first studies of "Freon" equipment, with the following section headings: low pressure condensing units (accessories recommended for base units), "Freon-12" condensers (terminal difference), and "Freon-12" water coolers (mean temperature difference).

■ **The air conditioning industry** is on the threshold of an era of unprecedented promotion, popularity and profit, according to P. Y. Danley, manager of Westinghouse' air conditioning department, in reviewing new equipment announced by the company last month. All indications point to the expansion of the market to be directed toward the apparel shops, markets, offices, hospitals, theaters, restaurants, schools, depots, barber shops, department stores, etc., according to Mr. Danley. . . Saturation in this market won't be a worry for many years, he said, for there are some 40,000 dry goods and small department or general stores, 125,000 restaurants, 64,000 beauty shops and barber shops, and 58,000 or 59,000 drug stores. To this list should be added the almost countless thousands of candy stores, small offices, apparel shops, banks, theaters, mortuaries, and a dozen additional prospects.

■ **Coal and coke**—After an interval of several years there has just been issued a new revised compilation of all A.S.T.M. standardized methods of testing, specifications and definitions pertaining to coal and coke. It includes some 28 standards in addition to a proposed test for agglutinating value of coal, and standard test procedures are given covering such subjects as sampling, fineness, grindability, drop shatter test, tumbler test, screen analysis, size designations and cubic foot weight. . . The specifications cover gas and coking coals, foundry coke, classification of coals by rank and by grade, and round-hole screens for testing. The definitions pertain to terms relating to coal and coke, gross and net calorific value and varieties of bituminous and subbituminous coals. . . . Copies of this 150 page publication, heavy paper binding, can be obtained from A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa., for $1.25 per copy.

■ **The A.S.M.E.** Undergraduate Student Award is to be bestowed upon Donald C. McSorley, formerly of Michigan State College, for his paper on humidity insulation, at the "Honors Night" to be held during the 59th annual meeting of the A.S.M.E. in New York City. Arthur C. Stern, consulting engineer, is to receive the A.S.M.E. Junior Award for his paper on separation and emission of cinders and fly ash.

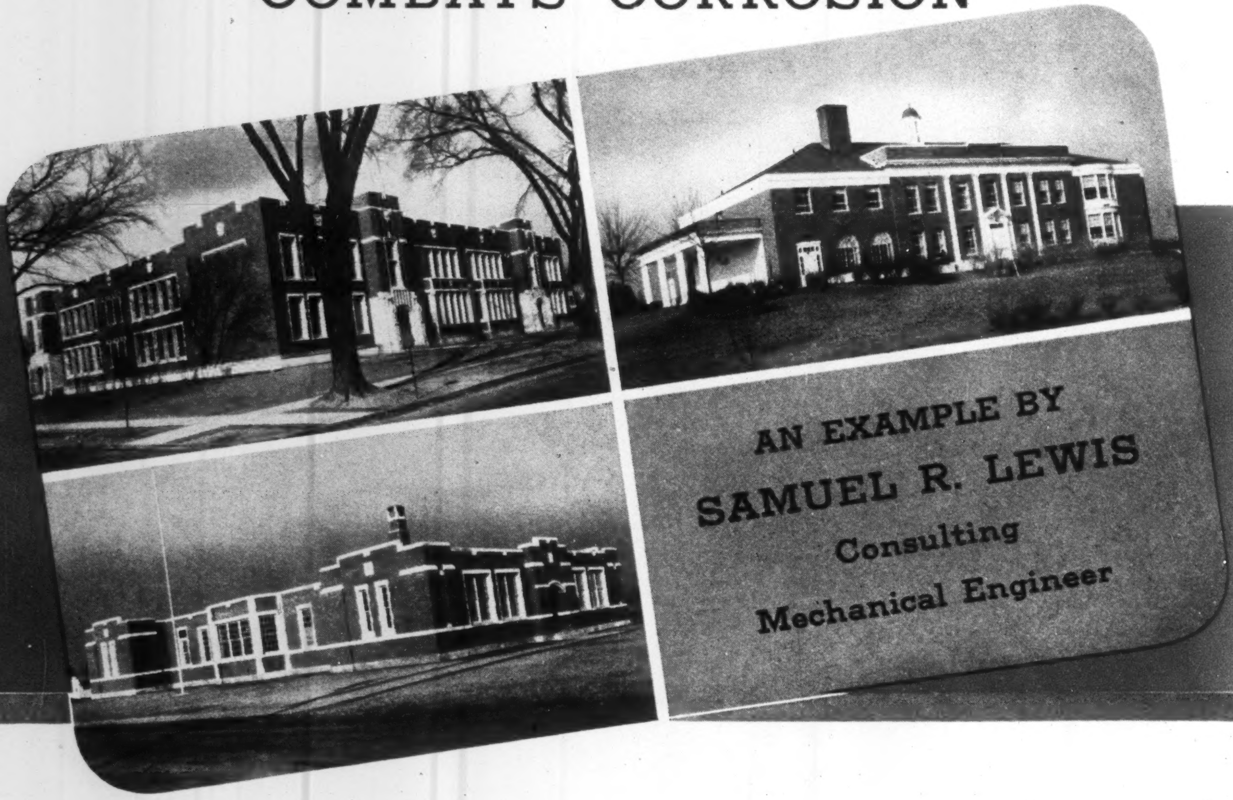
■ **Herbert J. Winn,** retiring president of the 87 year old Taylor Instrument Companies, becomes chairman of the board of directors and is succeeded in the presidency by Lewis B. Swift, who has served as vice-president in charge of engineering and research, it was announced last month. Karl H. Hubbard has been appointed chief engineer in charge of engineering research and design, and Dr. H. L. Mason has succeeded him as head of the research division.

IN 18 SCHOOLS

in a single city

BYERS WROUGHT IRON

COMBATS CORROSION



AN EXAMPLE BY
SAMUEL R. LEWIS
Consulting
Mechanical Engineer

Mr. Samuel R. Lewis, Consulting Mechanical Engineer of Chicago, followed a sound and accepted engineering principle in selecting materials for 18 school buildings in Toledo, Ohio. All are equipped with Byers Wrought Iron in back-air vents and all heating lines 1½" and larger. Three of these schools—Old Orchard, Stevens, and Warren Street—are illustrated.

You, too, may have a problem where corrosion threatens investment or profits. Without cost or obligation, our Engineering Service Department will: (1) Determine the probable corrosive conditions. (2) Compare these with kindred conditions recorded in data files covering thousands of case histories. (3) Interpret the results in terms of experience gained in three quarters of a century of contact with corrosion problems . . . and (4) Support the findings with service records of Wrought Iron in similar jobs. Just write, outlining your problem. If you would like a bulletin, "Wrought Iron for Piping Systems," ask our nearest Division Office . . . or write to headquarters. A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

Specify Byers Genuine Wrought Iron Pipe for corrosive services and Byers Steel Pipe for your other requirements

BYERS
GENUINE
WROUGHT IRON
Tubular and Flat Rolled Products

HEATING ◆ PIPING AND AIR CONDITIONING

January, 1938

DIRECTORY SECTION

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT *for* INDUSTRY AND LARGE BUILDINGS

HOW TO USE THIS DIRECTORY

If you want to know the names of one or more manufacturers making a certain product, look in Part 1, where that product will appear in its proper place in the listing. If you have the trade name of a product and want to know who manufactures it, look in Part 2, where trade names are alphabetically listed. For the complete name and address of any manufacturer look in Part 3.

● The manufacturers whose names are spotted throughout the listings advertise in this issue. See Index to Advertisers (on next page) for the page on which you will find the advertising of any of these manufacturers.

Heating, Piping and Air Conditioning, Chicago, Ill.

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●Cork Import Corp., New York, N. Y.
Cork Insulation Co., Inc., New York, N. Y.
Fabling Co., W. D., Los Angeles, Cal.
Felt Products Mfg. Co., Chicago, Ill.
Felters Co., Inc., Boston, Mass.
Firestone Tire & Rubber Co., Akron, O.
●General Electric Co., Schenectady, N. Y.
General Insulating & Mfg. Co., Alexandria, Ind.
Goodrich Co., B. F., Akron, O.
Korfund Co., Long Island City, N. Y.
Lehigh Fan & Blower Co., Allentown, Pa.
Lord Mfg. Co., Erie, Pa.
Manley Products Corp., York, Pa.
●Mundet Cork Corp., New York, N. Y.
Smidth & Co., F. L., New York, N. Y.
●Sturtevant Co., B. F., Boston, Mass.
Union Fibre Co., Inc., Winona, Minn.
United Cork Companies, Lyndhurst, N. J.
United States Gypsum Co., Chicago, Ill.
Vibration Eliminator Co., Long Island City, N. Y.

BEARINGS, BALL
Ahlberg Bearing Co., Chicago, Ill.
Bearings Co. of America, Lancaster, Pa.
Fafnir Bearing Co., New Britain, Conn.
Johnson Bronze Co., New Castle, Pa.
New Departure Div., General Motors Corp., Bristol, Conn.
●Norma-Hoffmann Bearings Corp., Stamford, Conn.
Schatz Mfg. Co., Fairview, Poughkeepsie, N. Y.
Shafer Bearing Corp., Chicago, Ill.
SKF Industries, Inc., Philadelphia, Pa.
Wood's Sons Co., T. B., Chambersburg, Pa.

BEARINGS, ROLLER
Fafnir Bearing Co., New Britain, Conn.
Hyatt Roller Bearing Co., Harrison, N. J.
Medart Co., St. Louis, Mo.
●Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Trenton, N. J.
Shafer Bearing Corp., Chicago, Ill.
SKF Industries, Inc., Philadelphia, Pa.
Timken Roller Bearing Co., Canton, O.

BEARINGS, SLEEVE
Johnson Bronze Co., New Castle, Pa.
●Randall Graphite Products Corp., Chicago, Ill.

BELLOWS, METALLIC
Bishop & Babcock Sales Co., Cleveland, O.
Bridgeport Brass Co., Bridgeport, Conn.
Bridgeport Thermostat Co., Bridgeport, Conn.
Cashin Co., W. D., Boston, Mass.
●Clifford Mfg. Co., Boston, Mass.
Cook Electric Co., Chicago, Ill.
●Fulton Sylphon Co., Knoxville, Tenn.

BELTING, FLAT, LEATHER
Alexander Bros., Inc., Philadelphia, Pa.
Chicago Belting Co., Chicago, Ill.
Graton & Knight, Worcester, Mass.
Houghton & Co., E. F., Philadelphia, Pa.
Rhoads & Sons, J. E., Wilmington, Del.
Williams & Son, I. B., Dover, N. H.

BELTING, FLAT, RUBBER
Boston Woven Hose & Rubber Co., Cambridge, Mass.
Continental Rubber Wks., Erie, Pa.
Dick Co., Inc., R. & J., Passaic, N. J.
Firestone Tire & Rubber Co., Akron, O.
Garlock Packing Co., Palmyra, N. Y.
Gilmer Co., L. H., Philadelphia, Pa.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Hamilton Rubber Mfg. Co., Trenton, N. J.
Jeffrey Mfg. Co., Columbus, O.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Republic Rubber Co., Youngstown, O.
Thermoid Rubber Co., Trenton, N. J.
United States Rubber Products, Inc., New York, N. Y.

BELTS, V
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Browning Mfg. Co., Inc., Ohio Valley Pulley Works, Div., Maysville, Ky.
Continental Rubber Wks., Erie, Pa.

●Advertisement in this issue. See Index to Advertisers, page 232.

●Dayton Rubber Mfg. Co., Dayton, O.
Dick Co., Inc., R. & J., Passaic, N. J.
Gates Rubber Co., Denver, Colo.
Gilmer Co., L. H., Philadelphia, Pa.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Medart Co., St. Louis, Mo.
Rockwood Mfg. Co., Indianapolis, Ind.
Thermoid Rubber Co., Trenton, N. J.
United States Rubber Products, Inc., New York, N. Y.
Wood's Sons Co., T. B., Chambersburg, Pa.
●**Worthington Pump & Machinery Corp., Harrison, N. J.**

BENDERS, CONDUIT AND PIPE

American Pipe Bending Machine Co., Inc., Boston, Mass.
American Pipe Tool Co., Chicago, Ill.
Bernz Co., Inc., Otto, Rochester, N. Y.
●**Buffalo Forge Co., Buffalo, N. Y.**
Grabler Mfg. Co., Cleveland, O.
Hays Mfg. Co., Erie, Pa. (Copper tube)
Hollands Mfg. Co., Erie, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Jenkins Mfg. Co., New York, N. Y.
Martin & Sons, H. P., Owensboro, Ky.
Nye Tool & Machine Wks., Chicago, Ill.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
Toledo Pipe Threading Machine Co., Toledo, O.
Vanderman Mfg. Co., Willimantic, Conn.
Wallace Supplies Mfg. Co., Chicago, Ill.
●Williams & Co., J. H., New York, N. Y.

BENDS, EXPANSION, STEAM PIPE

Blaw-Knox Co., Blawnox, Pa.
●**Crane Co., Chicago, Ill.**
Floersheim & Co., B., Pittsburgh, Pa.
●Frick Co., Waynesboro, Pa.
●**Grinnell Co., Inc., Providence, R. I.**
Harris & Co., Arthur, Chicago, Ill. (Stainless & non-ferrous)
Harrisburg Steel Corp., Harrisburg, Pa.
Kellogg Co., M. W., The, New York, N. Y. (Corrugated steel)
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden Van Stone Co., South Boston, Mass.
●**Midwest Piping & Supply Co., Inc., St. Louis, Mo.**
●National Pipe Bending Co., New Haven, Conn.
National Valve & Mfg. Co., Pittsburgh, Pa.
Ohio Pipe Bending & Machine Co., Cleveland, O.
Parks-Cramer Co., Fitchburg, Mass.
Pittsburgh Pipe Coil & Bending Co., Etna, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Power Piping Co., Pittsburgh, Pa.
●Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Shaw Co., Benjamin F., Wilmington, Del.
Shaw-Kendall Engineering Co., Toledo, O.
Vogt Machine Co., Henry, Louisville, Ky.

BI-METALS, THERMOSTATIC

Callite Products Co., Union City, N. J.
Chace Valve Co., W. M., Detroit, Mich.
Dole Valve Co., Chicago, Ill.
General Plate Co., Attleboro, Mass.
Laminated Metals Corp., Providence, R. I.
Wilson Co., H. A., Newark, N. J.

BLADES, FAN

Berns Specialty Co., Chicago, Ill.
Browning Mfg. Co., Inc., Ohio Valley Pulley Works, Div., Maysville, Ky.
●**Buffalo Forge Co., Buffalo, N. Y.**
●**Clarage Fan Co., Kalamazoo, Mich.**
Dallas Engineering Co., Dallas, Tex.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
International Engrg., Inc., Dayton, O.
Janette Mfg. Co., Chicago, Ill.
Meier Electric & Machine Co., Indianapolis, Ind.
Myers Electric Co., Pittsburgh, Pa.
Peerless Electric Co., Warren, O.
Reed Unit-Fans, Inc., New Orleans, La.
Schwitzer-Cummins Co., Indianapolis, Ind.
●**Torrington Mfg. Co., Torrington, Conn.**

BLAST HEATERS

See Surface, Heating

BLAST HEATING COILS

See Surface, Heating

BLINDS, VENETIAN

Athey Co., Chicago, Ill.
Bostwick-Goodell Co., Norwalk, O. (Shutter awnings)
Chicago Venetian Blind Co., Chicago, Ill.
Columbia Mills, Inc., Saginaw, Mich.
Higgin Mfg. Co., Newport, Ky.
Hough Co., Janesville, Wis.
Kane Mfg. Corp., Kane, Pa.
Miller & Connell Co., Chicago, Ill.
Mitchell Moulding Co., Forest Park, Ill.
Patterson Shade Co., Indianapolis, Ind.
Schatz Venetian Blinds, Los Angeles, Cal.
Snead, Herbert S., New York, N. Y.
Standard Products Co., Detroit, Mich.
Swedish Venetian Blind Co., New York, N. Y.
Warren Shade Co., Inc., Minneapolis, Minn.
Western Venetian Blind Co., New York, N. Y.
Yardley Screen & Weather Strip Co., Columbus, O.

BLOCKS, PILLOW

Ahlberg Bearing Co., Chicago, Ill.
Air Controls, Inc., Cleveland, O.
Caldwell Co., W. E., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Clizbe Bros. Mfg. Co., Plymouth, Ind.
Dick Co., Inc., R. & J., Passaic, N. J.
Fafnir Bearing Co., New Britain, Conn. (Ball bearings
●**Frick Co., Waynesboro, Pa.**
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Medart Co., St. Louis, Mo.
Peerless Electric Co., Warren, O.
●**Randall Graphite Products Corp., Chicago, Ill.**
Royersford Foundry & Machine Co., Inc., Royersford, Pa
Schwitzer-Cummins Co., Indianapolis, Ind.
SKF Industries, Inc., Philadelphia, Pa.
Shafer Bearing Corp., Chicago, Ill.
Smith, Inc., Winfield H., Springville, N. Y.
Sprout, Waldron & Co. Muncy Pa.
Viking Air Conditioning Corp. Cleveland, O.
Wood's Sons Co., T. B., Chambersburg, Pa.

BLOWERS

See Fans, Centrifugal

BLOWERS, PRESSURE

●**Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
●American Blower Corp., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Beach-Russ Co., New York, N. Y.
●**Buffalo Forge Co., Buffalo, N. Y.**
Champion Blower & Forge Co., Lancaster, Pa.
●**Clarage Fan Co., Kalamazoo, Mich.**
Cleaver-Brooks Co., Milwaukee, Wis.
Dean Bros. Co., Indianapolis, Ind.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Eclipse Fuel Engineering Co., Rockford, Ill.
Garden City Fan Co., Chicago, Ill.
●**Ingersoll-Rand Co., New York, N. Y.**
Janette Mfg. Co., Chicago, Ill.
Muncie Gear Wks., Muncie, Ind.
Roots-Connersville Blower Corp., Connersville, Ind.
Spencer Turbine Co., Hartford, Conn.
●**Sturtevant Co., B. F., Boston, Mass.**
Trimount Rotary Power Co., East Dedham, Mass.
●**Wing Mfg. Co., L. J., New York, N. Y.**

BLOWERS, SOOT

Bayer Co., St. Louis, Mo.
Diamond Power Specialty Co., Detroit, Mich.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Marion Machine Foundry & Supply Co., Marion, Ind.

BLOWER WHEELS

See Wheels, Blower

BLOW-OFF VALVES

See Valves, Blow-Off

BOILER CLEANING COMPOUNDS

See Compounds, Boiler Cleaning

BOILER COVERING

See Covering, Boiler and Tank

BOILER FEED PUMPS

See Pumps, Boiler Feed

BOILER FEEDERS

See Feeders, Water, Heating Boiler

BOILER SEALING COMPOUNDS

See Compounds, Boiler and Radiator Sealing

BOILER TUBES

See Tubes, Boiler

BOILERS, HEATING, CAST IRON, SECTIONAL

American Radiator Co., New York, N. Y.
Bryan Steam Corp., Peru, Ind.
Bryant Heater Co., Cleveland, O.
●**Burnham Boiler Corp., Irvington, N. Y.**
Columbia Radiator Co., McKeesport, Pa.
●**Crane Co., Chicago, Ill.**
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa
Farquhar Co., Ltd., A. B., York, Pa.
Hart & Crouse Co., Inc., Utica, N. Y.
Herbert Boiler Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Molby Boiler Co., New York, N. Y.
Mueller Furnace Co., L. J., Milwaukee, Wis.
National Radiator Corp., Johnstown, Pa.

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Pierce Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Frank, Terre Haute, Ind.
Reif-Rexoil, Inc., Buffalo, N. Y.
Richardson & Boynton Co., New York, N. Y.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Smith Co., H. B., Westfield, Mass.
Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa.
Thatcher Co., Newark, N. J.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Weil-McLain Co., Chicago, Ill.
XXth Century H. & V. Co., Akron, O.

BOILERS, HEATING, STEEL, FIRE TUBE

Ames Iron Wks., Div. of Pierce Butler Radiator Corp., Oswego, N. Y.
Bass Foundry & Machine Co., Ft. Wayne, Ind.
Bigelow Co., New Haven, Conn.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
●Burnham Boiler Corp., Irvington, N. Y.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., New York, N. Y.
Dillon Steam Boiler Wks., Inc., D. M., Fitchburg, Mass.
Eclipse Fuel Engineering Co., Rockford, Ill.
Erie City Iron Wks., Erie, Pa.
Farquhar Co, Ltd., A. B., York, Pa.
Farrar & Trefts, Buffalo, N. Y.
Fitzgibbons Boiler Co., Inc., New York, N. Y.
Frost Mfg. Co., Galesburg, Ill.
Gardner, Bernard, New York, N. Y.
Heil Co., Milwaukee, Wis.
Herbert Boiler Co., Chicago, Ill.
Hodge Boiler Wks., East Boston, Mass.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Inc., Framingham, Mass.
Johnston Bro., Inc., Ferrysburg, Mich.
Keeler Co., Williamsport, Pa.
●Kewanee Boiler Corp., Kewanee, Ill.
Koven & Bro., L. O., Jersey City, N. J.
Lookout Boiler & Mfg. Co., Chattanooga, Tenn.
Manitowoc Boiler Wks., Manitowoc, Wis.
McCormick & Co., J. H., Williamsport, Pa.
●Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
Murray Iron Wks. Co., Burlington, Ia.
National Radiator Corp., Johnstown, Pa.
Orr & Sembower, Inc., Reading, Pa.
Pacific Steel Boiler Div., United States Radiator Corp., Detroit, Mich.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Pressure Oil Burners, Inc., York, Pa.
Reif-Rexoil, Inc., Buffalo, N. Y.
Smith Twin Tubular Boiler Co., Inc., Philadelphia, Pa.
Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa.
●Titusville Iron Wks. Co., Titusville, Pa.
Union Iron Wks., Erie, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Waterfilm Boilers, Inc., Jersey City, N. J.
Wickes Boiler Co., Saginaw, Mich.
Wood Industries, Inc., Gar, Detroit, Mich.

BOILERS, HEATING, STEEL, WATER TUBE

Ames Iron Wks., Div. of Pierce Butler Radiator Corp., Oswego, N. Y.
Babcock & Wilcox Co., New York, N. Y.
Bass Foundry & Machine Co., Ft. Wayne, Ind.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Bryan Steam Corp., Peru, Ind.
Campbell Heating Co., E. K., Kansas City, Mo.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., New York, N. Y.
Edge Moor Iron Wks., New York, N. Y.
Erie City Iron Wks., Erie, Pa.
Farquhar Co., Ltd., A. B., York, Pa.
Foster Wheeler Corp., New York, N. Y.
Gardner, Bernard, New York, N. Y.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Inc., Framingham, Mass.
Joliet Heating Corp., Joliet, Ill.
Keeler Co., E., Williamsport, Pa.
●Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Murray Iron Wks. Co., Burlington Ia.
National Radiator Corp. Johnstown, Pa.
Orr & Sembower, Inc., Reading, Pa.
Riley Stoker Corp., Worcester, Mass.
Smith Twin Tubular Boiler Co., Inc., Philadelphia, Pa.
Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa.
●Titusville Iron Wks. Co., Titusville, Pa.
United States Radiator Corp., Detroit, Mich.
Vogt Machine Co., Henry, Louisville, Ky.
Wickes Boiler Co., Saginaw, Mich.

BOLTS AND STUDS, FLANGE

Bethlehem Steel Co., Bethlehem, Pa.
●Crane Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
Lamson & Sessions Co., Cleveland, O.
Multi-Seal Mfg. Co., Chicago, Ill.
●Republic Steel Corp., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOLTS, EXPANSION

Chase Brass & Copper Co., Waterbury, Conn.
Chicago Expansion Bolt Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Diamond Expansion Bolt Co., Garwood, N. J.
Multi-Seal Mfg. Co., Chicago, Ill.
Paine Co., Chicago, Ill.
Rawlplug Co., Inc., New York, N. Y.
●Republic Steel Corp., Cleveland, O.
Star Expansion Bolt Co., New York, N. Y.
U. S. Expansion Bolt Corp., New York, N. Y.

BOLTS, TOGGLE AND ANCHOR

Chicago Expansion Bolt Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Diamond Expansion Bolt Co., Garwood, N. J.
Grabler Mfg. Co., Cleveland, O.
Lamson & Sessions Co., Cleveland, O.
Multi-Seal Mfg. Co., Chicago, Ill.
Paine Co., Chicago, Ill.
Rawlplug Co., Inc., New York, N. Y.
●Republic Steel Corp., Cleveland, O.
Star Expansion Bolt Co., New York, N. Y.
U. S. Expansion Bolt Corp., New York, N. Y.

BRAKES, SHEET METAL

Bertsch & Co., Cambridge City, Ind.
Cincinnati Shaper Co., Cincinnati, O.
Dreis & Krump Mfg. Co., Chicago, Ill.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Heartley Machine & Tool Co., Toledo, O.
New Albany Machine Mfg. Co., New Albany, Ind.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Ohl & Son, George A., Newark, N. J.
Peck, Stow & Wilcox Co., Southington, Conn.
Rafter Machine Co., Belleville, N. J.
Steelweld Machinery Co., Cleveland, O.
Verson Allsteel Press Co., Chicago, Ill.
●Whitney Metal Tool Co., Rockford, Ill.

BRASS PIPE

See Pipe, Brass and Copper

BRASS UNIONS

Unions, Brass

BRASS VALVES

See Valves, Gate and Valves, Globe

BRAZING TORCHES

See Torches, Brazing

BRONZE VALVES

See Valves, Gate and Valves, Globe

BUILDING INSULATION

See Insulation, Building

BURNERS, COAL, AUTOMATIC

See Stokers

BURNERS, GAS, COMMERCIAL AND INDUSTRIAL

Babcock & Wilcox Co., New York, N. Y.
Barber Gas Burner Co., Cleveland, O.
Bryan Steam Corp., Peru, Ind.
Bryant Heater Co., Cleveland, O.
Burdett Mfg. Co., Chicago, Ill.
Campbell Heating Co., E. K., Kansas City, Mo.
Continental Stove Corp., Ironton, O.
Eclipse Fuel Engrg. Co., Rockford, Ill.
Engineer Co., New York, N. Y.
Hugo Mfg. Co., West Duluth, Minn.
●Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Mettler Co., Lee B., Los Angeles, Cal.
National Airoil Burner Co., Inc., Philadelphia, Pa.
National Machine Wks., Chicago, Ill.
North American Mfg. Co., Cleveland, O.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Peabody Engrg. Corp., New York, N. Y.
R-S Products Corp., Philadelphia, Pa.
Reznor Mfg. Co., Mercer, Pa.
Roberts-Gordon Appliance Corp., Buffalo, N. Y.
Rotary Mfg. Co., Los Angeles, Cal.
Schutte & Koerting Co., Philadelphia, Pa.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Strong, Carlisle & Hammond Co., Cleveland, O.
Surface Combustion Corp., Toledo, O.

BURNERS, OIL, COMMERCIAL AND INDUSTRIAL

Ace Engineering Co., Chicago, Ill.
American Air Conditioning Corp., Sebastopol, Cal.
Babcock & Wilcox Co., New York, N. Y.
Bennett Corp., W. M., Omaha, Nebr.
Bryan Steam Corp., Peru, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Caloroil Burner Corp., Hartford, Conn.
Century Engrg. Corp., Cedar Rapids, Ia.
Chalmers Oil Burner Co., Minneapolis, Minn.
Chisholm Co., Allen E., Portland, Ore.
Combustion Engineering Co., Inc., New York, N. Y.
Connery Construction Co., Philadelphia, Pa.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
d'Este Co., Julian, Charlestown, Mass.
Electrol, Inc., Clifton, N. J.

●Advertisement in this issue. See Index to Advertisers, page 232.

- Engineer Co., New York, N. Y.
- Enterprise Oil Burner Co., San Francisco, Cal.
- Gilbert & Barker Mfg. Co., Springfield, Mass.
- Hardinge Oil Burner Co., Chicago, Ill.
- Heil Co., Milwaukee, Wis.
- Johnson Co., S. T., Oakland, Cal.
- Johnson Mfg. Co., Waterloo, Ia.
- Kisco Co., Inc., St. Louis, Mo.
- Kleen-Heet, Inc., Chicago, Ill.
- Lammert & Mann Co., Chicago, Ill.
- Littleford Bros., Cincinnati, O.
- Mettler Co., Lee B., Los Angeles, Cal.
- Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
- National Airoil Burner Co., Inc., Philadelphia, Pa.
- Norge Heating & Conditioning Div., Borg-Warner Corp., Detroit, Mich.
- North American Mfg. Co., Cleveland, O.
- Nu-Way Corp., Rock Island, Ill.
- Peabody Engrg. Corp., New York, N. Y.
- Petroleum Heat & Power Co., Stamford, Conn.
- Pressure Oil Burners, Inc., York, Pa.
- Ray Oil Burner Co., San Francisco, Cal.
- Reif-Rexoil, Inc., Buffalo, N. Y.
- Riley Stoker Corp., Worcester, Mass.
- Rotary Mfg. Co., Los Angeles, Cal.
- R-S Products Corp., Philadelphia, Pa.
- Schutte & Koerting Co., Philadelphia, Pa.
- Scott-Newcomb, Inc., St. Louis, Mo.
- Silent Glow Oil Burner Corp., Hartford, Conn.
- Simplex Oil Heating Corp., New York, N. Y.
- Staples & Pfeiffer, Ltd., San Francisco, Cal.
- Strong, Carlisle & Hammond Co., Cleveland, O.
- Sundstrand Machine Tool Co., Rockford, Ill.
- Todd Combustion Equipment, Inc., Brooklyn, N. Y.
- Wayne Oil Burner Corp., Fort Wayne, Ind.
- Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
- Wood Industries, Inc., Gar, Detroit, Mich.
- York Oil Burner Co., Inc., York, Pa.

CAST IRON PIPE

See Pipe, Cast Iron

CEMENT AND COMPOUNDS, PIPE JOINT

- Acorn Refining Co., Cleveland, O.
- Barber Co., Inc., Philadelphia, Pa.
- ●Bell & Gossett Co., Chicago, Ill.
- Blue Seal Chemical Co., Roselle Park, N. J.
- Burnley Battery & Mfg. Co., North East, Pa.
- Calbar Paint & Varnish Co., Philadelphia, Pa.
- Colebrooks Sons, Inc., W. H., Syracuse, N. Y.
- Cooper Sanitary Co., Philadelphia, Pa.
- ●Crane Co., Chicago, Ill.
- Croll & Son, Jesse G., Philadelphia, Pa.
- Desolvo Mfg. Co., Pittsburgh, Pa.
- Detroit Graphite Co., Detroit, Mich.
- Dixon Crucible Co., Joseph, Jersey City, N. J.
- Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
- ●Grinnell Co., Inc., Providence, R. I.
- Hercules Chemical Co., Inc., New York, N. Y.
- Key Co., East St. Louis, Ill.
- National Boiler Improvement Co., Washington, D. C.
- Northwestern Chemical Co., Marietta, O.
- ●Ric-wiL Co., Cleveland, O.
- Rockwood Sprinkler Co., Worcester, Mass.
- Sauereisen Cements Co., Sharpsburg, Pa.
- Schundler & Co., F. E., Long Island City, N. Y.
- Smooth-On Mfg. Co., Jersey City, N. J.
- Star Products Co., New York, N. Y.

CEMENT, INSULATING

- Acme Asbestos Covering & Flooring Co., Chicago, Ill.
- Bird-Archer Co., New York, N. Y.
- ●Carey Co., Philip, Lockland, Cincinnati, O.
- Eagle-Picher Lead Co., Cincinnati, O.
- Ehret Magnesia Mfg. Co., Valley Forge, Pa.
- General Insulating & Mfg. Co., Alexandria, Ind.
- Johns-Manville, New York, N. Y.
- Keasbey Co., Robert A., New York, N. Y.
- Keasbey & Mattison Co., Ambler, Pa.
- Mineral Felt Co., Toledo, O.
- Mineral Insulation Co., Chicago Ridge, Ill.
- Mortell Co., J. W., Chicago, Ill. (Adhesive)
- ●Owens-Illinois Glass Co., Toledo, O.
- Refractory & Insulation Corp., New York, N. Y.
- Rex Clay Products Co., Detroit, Mich.
- Ruberoid Co., New York, N. Y.
- Sall Mountain Co., Chicago, Ill.
- Sauereisen Cements Co., Sharpsburg, Pa.
- Schundler & Co., Inc., F. E., Long Island City, N. Y.
- Self-Vulcanizing Rubber Co., Inc., Chicago, Ill. (Rubber)
- Smith & Kanzler, Inc., Elizabeth, N. J.
- Standard Lime & Stone Co., Baltimore, Md.
- Therminsul Corp., Kalamazoo, Mich.
- Union Fibre Co., Inc., Winona, Minn.
- ●Wilson, Inc., Grant, Chicago, Ill.

CENTRIFUGAL PUMPS

See Pumps, Centrifugal

CHAIN DRIVES

See Drives, Chain

CHECK VALVES

See Valves, Check

CHILLERS, WATER, FOR AIR CONDITIONING AND REFRIGERATION

- ●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
- Filtrine Mfg. Co., Brooklyn, N. Y.
- ●Frick Co., Waynesboro, Pa.
- Griscom-Russell Co., New York, N. Y.
- Mojonnier Bros. Co., Chicago, Ill.
- ●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
- Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
- Sims Co., Erie, Pa.
- ●Vilter Mfg. Co., Milwaukee, Wis.
- ●Whitlock Coil Pipe Co., Hartford, Conn.
- ●York Ice Machinery Corp., York, Pa.

CIRCULATORS, FOR HOT WATER HEATING SYSTEMS

- Automatic Stoker Corp., Milwaukee, Wis.
- ●Bell & Gossett Co., Chicago, Ill.
- Berns Specialty Co., Chicago, Ill.
- Economy Pumps, Inc., Chicago, Ill.
- Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
- General Blower Co., Inc., Philadelphia, Pa.
- Hoosick Engineering Co., Inc., Hoosick Falls, N. Y.
- Janette Mfg. Co., Chicago, Ill.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- Penberthy Injector Co., Detroit, Mich.
- Sterling Engineering Co., Milwaukee, Wis.
- Stevens-Root Co., Chicago, Ill.
- Taco Heaters, Inc., New York, N. Y.
- Thrush & Co., H. A., Peru, Ind.
- Triplex Mfg. Co., Peru, Ind.
- Watts Regulator Co., Lawrence, Mass.
- Weil Pump Co., Chicago, Ill.
- Yeomans Bros. Co., Chicago, Ill.

CLAMPS, BEAM, PIPE HANGING

- Beaton & Cadwell Mfg. Co., New Britain, Conn.
- Chicago Nipple Mfg. Co., Chicago, Ill.
- Carpenter & Paterson, Inc., East Boston, Mass.
- ●Crane Co., Chicago, Ill.
- Crawford Co., Chicago, Ill.
- Farley Sleeve & Hanger Co., Cleveland, O.
- ●Frick Co., Waynesboro, Pa.
- Globe Machine & Stamping Co., Cleveland, O.
- Grabler Mfg. Co., Cleveland, O.
- ●Grinnell Co., Inc., Providence, R. I.
- Jarecki Mfg. Co., Erie, Pa.
- ●Malleable Iron Fittings Co., Branford, Conn.
- Paine Co., Chicago, Ill.
- Pittsburgh Valve & Fittings Corp., Barberton, O.
- ●Walworth Co., New York, N. Y.

CLAMPS, PIPE REPAIR

- Blair Products Co., New York, N. Y.
- Chelsea Metal Stamping Co., New York, N. Y.
- Dresser Mfg. Co., S. R., Bradford, Pa.
- Jarecki Mfg. Co., Erie, Pa.
- Skinner Co., M. B., South Bend, Ind.

CLEANERS, TUBE

- Pierce Co., Wm. B., Buffalo, N. Y.

COILS

See Surface, Cooling; Surface, Heating

COLLECTORS, DUST

- ●Airtherm Mfg. Co., St. Louis, Mo.
- Allen Billmyre Corp., South Norwalk, Conn.
- ●American Air Filter Co., Louisville, Ky.
- ●American Blower Corp., Detroit, Mich.
- American Foundry Equipment Co., Mishawaka, Ind.
- Belanger Fan & Blower Co., Detroit, Mich.
- Blower Application Co., Milwaukee, Wis.
- Bubar, Hudson H., New York, N. Y.
- ●Buffalo Forge Co., Buffalo, N. Y.
- Columbian Steel Tank Co., Kansas City, Mo.
- Diamond Power Specialty Co., Detroit, Mich.
- Dracco Corp., Cleveland, O.
- Falstrom Co., Passaic, N. J.
- Goethel Co., Alfred C., Milwaukee, Wis.
- Goethel Sheet Metal Wks., Alfred, Milwaukee, Wis.
- Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
- Jacobs Co., B. & J., Cincinnati, O.
- Kirk & Blum Mfg. Co., Cincinnati, O.
- Knickerbocker Co., Jackson, Mich.
- Lehigh Fan & Blower Co., Allentown, Pa.
- New York Blower Co., Chicago, Ill.
- Niagara Blower Co., New York, N. Y.
- Northern Blower Co., Cleveland, O.
- Pangborn Corp., Hagerstown, Md.
- ●St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
- Schneible Co., Claude B., Chicago, Ill.
- Sly Mfg. Co., W. W., Cleveland, O.
- Sprout Waldron & Co., Muncy, Pa.
- Strandwitz & Co., Inc., Camden, N. J.
- ●Sturtevant Co., B. F., Boston, Mass.
- ●Westinghouse Electric & Mfg. Co., Mansfield, O. (Electrostatic precipitator).

●Advertisement in this issue. See Index to Advertisers, page 232.

COMBUSTION CONTROL
See Regulators, Draft

COMBUSTION RECORDERS
See Recorders, Combustion

COMFORT AIR CONDITIONERS
See Unit Air Conditioners, Comfort

COMPOUNDS, BOILER, CLEANING

American Teksag Products, Inc., Mount Vernon, N. Y.
Aquatic Chemical Laboratories, Inc., New York, N. Y.
Blue Seal Chemical Co., Roselle Park, N. J.
Chicago Specialty Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Dissolene Corp., Hempstead, N. Y.
Dole Valve Co., Chicago, Ill.
Ferro-Nil Corp., New York, N. Y.
Haering & Co., Inc., D. W., Chicago, Ill.
Hercules Chemical Co., Inc., New York, N. Y.
Kisco Co., Inc., St. Louis, Mo.
Radiator Specialty Co., Charlotte, N. C.
Star Products Co., New York, N. Y.
Vinco Co., Inc., New York, N. Y.
X Laboratories, New York, N. Y.

COMPOUNDS, BOILER AND RADIATOR SEALING

Blue Seal Chemical Co., Roselle Park, N. J.
Chicago Specialty Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Croll & Son, Jesse G., Philadelphia, Pa.
Desolvo Mfg. Co., Pittsburgh, Pa.
Dole Valve Co., Chicago, Ill.
Hercules Chemical Co., Inc., New York, N. Y.
Northwestern Chemical Co., Marietta, O.
Radiator Specialty Co., Charlotte, N. C.
Star Products Co., New York, N. Y.
Vinco Co., Inc., New York, N. Y.
X Laboratories, New York, N. Y.

COMPOUNDS, CALKING

All Metal Weatherstrip Co., Chicago, Ill.
Calbar Paint & Varnish Co., Philadelphia, Pa.
●Carey Co., Philip, Cincinnati, O.
Eagle-Picher Lead Co., Cincinnati, O.
Johns-Manville, New York, N. Y.
Pecora Paint Co., Philadelphia, Pa.
Sauereisen Cements Co., Sharpsburg, Pa.
Yardley Screen & Weather Strip Corp., Columbus, O.

COMPRESSOR BASES
See Bases and Pads, Vibration Isolating

COMPRESSORS, AIR

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●American-Marsh Pumps, Inc., Battle Creek, Mich.
●Binks Mfg. Co., Chicago, Ill.
Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Dayton Air Compressor Co., Dayton, O.
●Fedders Mfg. Co., Buffalo, N. Y.
Fuller Co., Catasauqua, Pa.
Gardner-Denver Co., Quincy, Ill.
Hobart Bros., Troy, O.
●Ingersoll-Rand, New York, N. Y.
Janette Mfg. Co., Chicago, Ill.
Kellogg Compressor & Mfg. Corp., Rochester, N. Y.
Kinney Mfg. Co., Boston, Mass.
Metals Coating Co. of America, Philadelphia, Pa.
Mills Novelty Co., Chicago, Ill.
●Nash Engineering Co., South Norwalk, Conn.
Norwalk Co., Inc., S. Norwalk, Conn.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Plummer Spray Equipment Co., Napoleon, O.
Schramm, Inc., West Chester, Pa.
Spencer Turbine Co., Hartford, Conn.
Trimount Rotary Power Co., East Dedham, Mass.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

COMPRESSORS, REFRIGERATING, CENTRIFUGAL

Carrier Corp., Syracuse, N. Y. (Carrene).
DeLaval Steam Turbine o., Trenton, N. J. (Water vapor)
●Ingersoll-Rand, New York, N. Y. (Water vapor)

COMPRESSORS, REFRIGERATING, RECIPROCATING

Advanced Refrigerating Systems Co., Philadelphia, Pa.
Airtemp, Inc., Detroit, Mich. (Radial).
●Baker Ice Machine Co., Inc., Omaha, Nebr. ("Freon," methyl chloride, ammonia).
Brunner Mfg. Co., Utica, N. Y. (Methyl chloride, "Freon," sulphur dioxide).
Builders Iron Foundry, Providence, R. I.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J. ("Freon," ammonia, carbon dioxide, methyl chloride).
Carrier Corp., Syracuse, N. Y. (Ammonia, "Freon," methyl chloride, carbon dioxide).
Copeland Refrigeration Corp., Mt. Clemens, Mich.
Corozone Air Conditioning Corp., Cleveland, O.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
De La Vergne Engine Co., Philadelphia, Pa. (Ammonia, "Freon").
Delco Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O. ("Freon").
Fairbanks, Morse & Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa. (Ammonia, carbon dioxide, methyl chloride, "Freon").
●General Electric Co., Schenectady, N. Y.
General Refrigeration Corp., Beloit, Wis.
Hardy Mfg. Co., Inc., Dayton, O. (Sulphur dioxide, methyl chloride).
Howe Ice Machine Co., Chicago, Ill. ("Freon," ammonia, methyl chloride).
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kellogg Compressor & Mfg. Corp., Rochester, N. Y.
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Merchant & Evans Co.. Philadelphia, Pa. ("Freon," methyl chloride, sulphur dioxide).
Mills Novelty Co., Chicago, Ill.
Nash Refrigeration Co., Inc., Newark, N. J.
Norge Heating & Conditioning Div., Borg-Warner Corp., Detroit, Mich.
Norwalk Co., Inc., S. Norwalk, Conn. (Carbon dioxide).
Phoenix Ice Machine Co., Cleveland, O.
Reliance Refrigerating Machine Co., Chicago, Ill. ("Freon," methyl, ammonia).
Servel Inc., Commercial Refrigeration Division, Evansville, Ind. ("Freon," methyl chloride).
Starr Piano Co., Richmond, Ind.
Stewart Ice Machine Co., Los Angeles, Cal.
Tecumseh Products Co., Tecumseh, Mich.
Thermal Units Mfg. Co., Meriden, Conn. ("Freon").
Triumph Ice Machine Co., Cincinnati, O. (Ammonia).
Uniflow Mfg. Co., Erie, Pa. (Sulphur dioxide, methyl chloride).
●Universal Cooler Corp., Detroit, Mich. (Methyl chloride, "Freon").
●Vilter Mfg. Co., Milwaukee, Wis. ("Freon," ammonia).
Vogt Machine Co., Henry, Louisville, Ky. (Ammonia).
●Westinghouse Electric & Mfg. Co., Mansfield, O.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill. ("Freon," methyl chloride).
Wittenmeier Machinery Co., Chicago, Ill. (Carbon dioxide).
XL Refrigerating Co., Chicago, Ill. (Ammonia, methyl chloride).
●York Ice Machinery Corp., York, Pa. (Carbon dioxide, ammonia, "Freon").

COMPRESSORS, REFRIGERATING, STEAM JET

●American Blower Corp., Detroit, Mich.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y.
Croll-Reynolds Engrg. Co., Inc., New York, N. Y.
Elliott Co., Jeannette, Pa.
Foster Wheeler Corp., New York, N. Y.
Graham Mfg. Co., Inc., Buffalo, N. Y.
●Ingersoll-Rand, New York, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.

CONDENSATION METERS
See Meters, Condensation

CONDENSATION PUMPS
See Pumps, Condensation

CONDENSERS, EVAPORATIVE

●Baker Ice Machine Co., Inc., Omaha, Nebr.
●Buffalo Forge Co., Buffalo, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carraway-Byrd Engineering Co., Dallas, Tex.
Carrier Corp., Syracuse, N. Y.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
●Frick Co., Waynesboro, Pa.
General Refrigeration Corp., Beloit, Wis.
Long Mfg. Co., Div. Borg-Warner Corp., Detroit, Mich.
Mayflower-Lewis Corp., St. Paul, Minn.
●Motor Equipment Co., Wichita, Kans.
Peerless of America, Inc., Chicago, Ill.
Stewart Ice Machine Co., Los Angeles, Cal.
Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
●Westinghouse Electric & Mfg. Co., Mansfield, O.
XL Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

CONDENSERS, REFRIGERATING

Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
●Bush Mfg. Co., Hartford, Conn.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y. (Carrene).
De La Vergne Engine Co., Philadelphia, Pa.

●Advertisement in this issue. See Index to Advertisers, page 232.

Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●Frick Co., Waynesboro, Pa.
●G. & O. Mfg. Co., New Haven, Conn.
General Refrigeration Corp., Beloit, Wis.
Howe Ice Machine Co., Chicago, Ill.
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Manufacturers Fin Coil Co., Chicago, Ill.
Mayflower-Lewis Corp., St. Paul, Minn.
Nash Refrigeration Co., Inc., Newark, N. J.
Ohio Pipe Bending & Machine Co., Cleveland, O.
Reliance Refrigerating Machine Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Stewart Ice Machine Co., Los Angeles, Cal.
Struthers-Wells-Titusville Co., Warren, Pa.
Thermal Units Mfg. Co., Meriden, Conn.
Trenton Auto Radiator Wks., Trenton, N. J.
Triumph Ice Machine Co., Cincinnati, O.
●Unit Heater & Cooler Co., Wausau, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Vogt Machine Co., Henry, Louisville, Ky.
●Westinghouse Electric & Mfg. Co., Mansfield, O.
Wittenmeier Machinery Co., Chicago, Ill.
XL Refrigerating Co., Chicago, Ill.
Yates-American Machine Co., Beloit, Wis.
●York Ice Machinery Corp., York, Pa.

CONDENSERS, STEAM

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Chicago Pneumatic Tool Co., New York, N. Y.
Columbian Steel Tank Co., Kansas City, Mo.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Elliott Co., Jeannette, Pa.
Foster Wheeler Corp., New York, N. Y.
Graham Mfg. Co., Buffalo, N. Y.
Murray Iron Wks. Co., Burlington, Ia.
●National Pipe Bending Co., New Haven, Conn.
Richmond Engineering Co., Richmond, Va.
Rome-Turney Radiator Co., Rome, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
●Unit Heater & Cooler Co., Wausau, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

CONDENSING UNITS

See Compressors

CONDUIT, UNDERGROUND PIPING

●American District Steam Co., North Tonawanda, N. Y.
Dockstader, S. E., Washington, D. C.
Johns-Manville, New York, N. Y.
●Porter & Co., Inc., H. W., Newark, N. J.
●Ric-wiL Co., Cleveland, O.
Underground Steam Construction Co., Boston, Mass.
Wyckoff & Son Co., A., Elmira, N. Y.

CONTROLLERS AND STARTERS, MOTOR

●Allen-Bradley Co., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Clark Controller Co., Cleveland, O.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
Durakool, Inc., Elkhart, Ind.
Electric Controller & Mfg. Co., Cleveland, O.
Electric Machinery Co., Minneapolis, Minn.
●General Electric Co., Schenectady, N. Y.
●Hart Mfg. Co., Hartford, Conn.
Monitor Controller Co., Baltimore, Md.
Square D Co., Detroit, Mich.
Trumbull Electric Mfg. Co., Plainville, Conn.
Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONTROLS, HUMIDITY AND TEMPERATURE

See Humidistats, Recorder-Controllers, Thermostats

CONTROLS, REFRIGERATION

See Valves, Refrigeration

CONVECTORS

See Radiation, Convection Type

COOLING COILS

See Surface, Cooling

COOLING SURFACE

See Surface, Cooling

COOLING TOWERS

See Towers, Cooling

COOLING UNITS

See Unit Air Conditioners, Cooling and Dehumidifying

COPPER PIPE

See Pipe, Brass and Copper

COPPER SHEETS

See Sheets, Copper

COPPER TUBE FITTINGS

See Fittings, Copper Tube

COPPER TUBING

See Tubing, Copper

COUNTERS, DUST

Bausch & Lomb Optical Co., Rochester, N. Y.

COUPLINGS, FLEXIBLE, POWER TRANSMISSION

Ajax Flexible Coupling Co., Westfield, N. Y.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Flexible Coupling Co., Erie, Pa.
Bartlett Hayward Co., Baltimore, Md.
Blood Brothers, Allegan, Mich. (Universal joints)
Bordo Co., Inc., L. J., Glenside, Pa.
Boston Gear Wks., Inc., North Quincy, Mass.
Caldwell Co., W. E., Louisville, Ky.
Certified Flexible Couplings, Inc., New York, N. Y.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Clark Controller Co., Cleveland, O.
Continental Diamond Fibre Co., Newark, Del.
Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.
De Laval Steam Turbine Co., Trenton, N. J.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Dick Co., Inc., R. & J., Passaic, N. J.
Flexo Supply Co., Inc., St. Louis, Mo.
General Blower Co., Inc., Philadelphia, Pa.
Guardian Utilities Co., Chicago, Ill.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
Link-Belt Co., Chicago, Ill.
Lovejoy Tool Wks., Chicago, Ill.
Medart Co., St. Louis, Mo.
Moran Flexible Steam Joint Co., Louisville, Ky.
Morse Chain Co., Ithaca, N. Y.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Poole Foundry & Machine Co., Baltimore, Md.
Smith, Inc., Winfield H., Springville, N. Y.
Strong-Scott Mfg. Co., Minneapolis, Minn.
Waldron Corp., John, New Brunswick, N. J.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Whitney Mfg. Co., Hartford, Conn.
Wood's Sons Co., T. B., Chambersburg, Pa.

COUPLINGS, PIPE

Barco Mfg. Co., Chicago, Ill. (Flexible).
Champion Machine & Forging Co., Cleveland, O.
Chase Brass & Copper Co., Waterbury, Conn.
Cohoes Rolling Mill Co., Cohoes, N. Y.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Dresser Mfg. Co., S. R., Bradford, Pa.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Harrisburg Steel Corp., Harrisburg, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis.
Hatch, George E., New York, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
King Union Co., Inc., Hillsgrove, R. I.
●Malleable Iron Fittings Co., Branford, Conn.
●National Tube Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Ravena Iron Co., Ravena, N. Y. (Cast iron).
Reading Iron Co., Philadelphia, Pa.
●Republic Steel Corp., Cleveland, O.
Semler Co., Jeannette, Pa.
Standard Auto-Tite Joint Co., Pittsburgh, Pa.
Taylor Forge & Pipe Wks., Chicago, Ill.
Union Metal Wks., Inc., Chelsea, Mass.
Victaulic Co. of America, New York, N. Y.
●Walworth Co., New York, N. Y.
Weatherhead Co., Cleveland, O.
●Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.

COVERING, BOILER AND TANK

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Alfol Insulation Co., Inc., New York, N. Y.
●Armstrong Cork Products Co., Lancaster, Pa.
●Carey Co., Philip, Lockland, Cincinnati, O.
Eagle-Picher Lead Co., Cincinnati, O.
General Insulating & Mfg. Co., Alexandria, Ind.
International Vermiculite Co., Springfield, Ill.
Jamar Co., Walker, Duluth, Minn.
Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Mineral Felt Co., Toledo, O.
●Owens-Illinois Glass Co., Toledo, O. (Blanket)
Ruberoid Co., New York, N. Y. (Asbestos, magnesia)
Sall Mountain Co., Chicago, Ill.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Smith & Kanzler, Inc., Elizabeth, N. J.
Standard Asbestos Mfg. Co., Chicago, Ill.
Therminsul Corp., Kalamazoo, Mich.
Union Fibre Co., Inc., Winona, Minn.
●Wilson, Inc., Grant, Chicago, Ill.

● Advertisement in this issue. See Index to Advertisers, page 232.

COVERING, PIPE

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Alfol Insulation Co., Inc., New York, N. Y.
●American District Steam Co., North Tonawanda, N. Y. (Underground).
●Armstrong Cork Products Co., Lancaster, Pa. (Cork).
●Carey Co., Philip, Lockland, Cincinnati, O. (Asbestos, magnesia).
●Cork Import Corp., New York., N. Y.
Cork Insulation Co., New York, N. Y.
●Crane Co., Chicago, Ill. (Asbestos).
Eagle-Picher Lead Co., Cincinnati, O.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
General Insulating & Mfg. Co., Alexandria, Ind. (Moulded).
International Vermiculite Co., Springfield, Ill. (Vermiculite).
Jamar Co., Walker, Duluth, Minn.
Johns-Manville, New York, N. Y. (Asbestos, magnesia, rock cork).
Keasbey Co., Robert A., New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa. (Asbestos, magnesia).
Miller Rubber Co., Inc., Akron, O.
Mineral Felt Co., Toledo, O.
●Mundet Cork Corp., New York, N. Y. (Cork).
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Asbestos, magnesia).
●Owens-Illinois Glass Co., Toledo, O. (Glass wool).
●Porter & Co., Inc., H. W., Newark, N. J. (Underground).
●Ric-wiL Co., Cleveland, O. (Underground).
Ruberoid Co., New York, N. Y. (Asbestos, magnesia).
Sall Mountain Co., Chicago, Ill. (Asbestos).
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Self-Vulcanizing Rubber Co., Inc., Chicago, Ill. (Rubber).
Smith & Kanzler, Inc., Elizabeth, N. J. (Asbestos air cell, wool felt and hair felt).
Standard Asbestos Mfg. Co., Chicago, Ill.
Standard Lime & Stone Co., Baltimore, Md. (Rockwool).
Therminsul Corp., Kalamazoo, Mich.
Union Fibre Co., Inc., Winona, Minn.
United Cork Companies, Lyndhurst, N. J.
●Wilson, Inc., Grant, Chicago, Ill.
Wyckoff & Son Co., A., Elmira, N. Y. (Wood).

CUTTERS, PIPE AND TUBING

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Barnes Tool Co., New Haven, Conn.
●Beaver Pipe Tools, Inc., Warren, O.
●Crane Co., Chicago, Ill.
Erie Tool Wks., Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hollands Mfg. Co., Erie, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Nye Tool & Machine Wks., Chicago, Ill.
Parker Appliance Co., Cleveland, O.
●Ridge Tool Co., Elyria, O.
Toledo Pipe Threading Machine Co., Toledo, O.
Trimont Mfg. Co., Boston, Mass.
Vanderman Mfg. Co., Willimantic, Conn.
Weatherhead Co., Cleveland, O.

DAMPER OPERATORS

See Operators, Damper

DAMPER QUADRANTS

See Quadrants, Damper

DAMPERS, DUCT

●Air Conditioning Products Co., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American Warming & Ventilating Co., Toledo, O.
Brown, Wm. P., Springfield, Mass.
Burt Mfg. Co., Akron, O.
Chicago Metal Mfg. Co., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Elgo Shutter & Mfg. Co., Detroit, Mich.
Hampden Cornice Wks., Inc., Springfield, Mass.
Hart & Cooley Mfg. Co., Chicago, Ill.
●Henry Furnace & Foundry Co., Cleveland, O.
Iona Ventilator Co., Inc., Philadelphia, Pa.
Jacobs Co., B. & J., Cincinnati, O.
Jordan & Co., Paul R., Indianapolis, Ind.
King Ventilating Co., Owatonna, Minn.
Lennox Furnace Co., Marshalltown, Ia., and Syracuse, N. Y.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Strandwitz & Co., Inc., Camden, N. J.
●Tuttle & Bailey, Inc., New Britain, Conn.
United States Register Co., Battle Creek, Mich.

DAMPERS, REMOTE CONTROLLED

●Barber-Colman Co., Rockford, Ill.
Carrier Corp., Syracuse, N. Y.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
●Powers Regulator Co., Chicago, Ill.

DEAERATORS

Centrifix Corp., Cleveland, O.
Cochrane Corp., Philadelphia, Pa.
Croll-Reynolds Engrg. Co., Inc., New York, N. Y.
Elliott Co., Jeannette, Pa.
Hagan Corp., Pittsburgh, Pa.
Hoppes Mfg. Co., Springfield, O.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.

DEEP WELL PUMPS

See Pumps, Deep Well

DEHUMIDIFIERS, ADSORPTION

Advance Mfg. Co., Inc., Louisville, Ky.
American Injector Co., Detroit, Mich.
Bryant Heater Co., Cleveland, O. (Silica gel)
Carrier Corp., Syracuse, N. Y.
Mayflower-Lewis Corp., St. Paul, Minn.
Pittsburgh Lectrodryer Corp., Pittsburgh, Pa.
●Research Corp., New York, N. Y.
Somers, Inc., H. J., Detroit, Mich.
Surface Combustion Corp., Toledo, O.

DEHUMIDIFYING UNITS

See Unit Air Conditioners, Cooling and Dehumidifying

DETECTORS, LEAK, REFRIGERANT

Bernz Co., Inc., Otto, Rochester, N. Y.
Clayton & Lambert Mfg. Co., Detroit, Mich.
Hull Mfg. Co., Hagerstown, Md.
●Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Turner Brass Wks., Sycamore, Ill.

DIAPHRAGM VALVES

See Valves, Diaphragm

DIESEL ENGINES

See Engines, Diesel

DIFFUSERS, AIR

See Grilles

DOORS AND PANELS, ACCESS

American Foundry & Furnace Co., Bloomington, Ill.
●Auer Register Co., Cleveland, O.
●Clarage Fan Co., Kalamazoo, Mich.
Higgin Mfg. Co., Newport, Ky.
Kirk & Blum Mfg. Co., Cincinnati, O.
Rock Island Register Co., Rock Island, Ill.
●Sturtevant Co., B. F., Boston, Mass.
●Tuttle & Bailey, Inc., New Britain, Conn.
Walsh-Spencer Co., Boston, Mass.
Way Panel Loctor Co., Wollaston, Mass.

DOORS, REVOLVING

Atchison Revolving Door Co., Independence, Kans.
General Bronze Corp., Long Island City, N. Y.
Revolving Doors, Inc., New York, N. Y.
Newman Brothers, Inc., Cincinnati, O.
Van Kannel Revolving Door Co., New York, N. Y.

DRAFT GAGES

See Gages, Indicating, Draft

DRAFT RECORDERS

See Recorders, Draft

DRAFT REGULATORS

See Regulators, Draft

DRILLS, PORTABLE, ELECTRIC

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., New York, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago, Ill.
Millers Falls Co., Greenfield, Mass.
Stanley Wks., New Britain, Conn.
Starbuck & Sons, Inc., R. M., Hartford, Conn. (Rotary pipe hole saws).
U. S. Electrical Tool Co., Cincinnati, O.
Skilsaw, Inc., Chicago, Ill.

DRIVES, CHAIN

Boston Gear Works, Inc., North Quincy, Mass.
Caldwell Co., W. E., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Medart Co., St. Louis, Mo.
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Whitney Mfg. Co., Hartford, Conn.

DRIVES, FLAT BELT

(See also Belting, Leather and Belting, Rubber)

Alexander Bros., Philadelphia, Pa.
American Pulley Co., Philadelphia, Pa.
Browning Mfg Co., Inc., Ohio Valley Pulley Works, Div., Maysville, Ky.
Chicago Belting Co., Chicago, Ill.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Dick Co., Inc., R & J., Passaic, N. J.

●Advertisement in this issue. See Index to Advertisers, page 232.

Medart Co., St. Louis, Mo.
Rockwood Mfg. Co., Indianapolis, Ind.
Smith, Inc., Winfield H., Springville, N. Y.
Wood's Sons Co., T. B., Chambersburg, Pa.

DRIVES, V BELT

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Boston Gear Wks., Inc., North Quincy, Mass.
Browning Mfg. Co., Inc., Ohio Valley Pulley Works, Div., Maysville, Ky.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
●Dayton Rubber Mfg. Co., Dayton, O.
Dick Co., Inc., R. & J., Passaic, N. J.
Dodge Mfg. Co., Mishawaka, Ind.
●Frick Co., Waynesboro, Pa.
Gates Rubber Co., Denver, Colo.
Horton Mfg. Co., Minneapolis, Minn.
Jones Foundry Machine Co., W. A., Chicago, Ill.
Medart Co., St. Louis, Mo.
Pyott Foundry & Machine Co., Chicago, Ill.
Rockwood Mfg. Co., Indianapolis, Ind.
Smith, Inc., Winfield H., Springville, N. Y.
Wood's Sons Co., T. B., Chambersburg, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

DUAL THERMOSTATS

See Thermostats, Two Temperature or Dual

DUCT DAMPERS

See Dampers, Duct

DUCT HEATERS

See Heaters, Duct, Electric

DUCT INSULATION

See Insulation, Duct

DUCT THERMOSTATS

See Thermostats, Duct Type

DUCTS AND DUCT FITTINGS, PREFABRICATED

Acer & Whedon, Medina, N. Y.
Acme Tin Plate & Roofing Supply Co., Philadelphia, Pa.
●Carey Co., Philip, Cincinnati, O.
Chicago Metal Mfg. Co., Chicago, Ill.
Cincinnati Sheet Metal & Roofing Co., Cincinnati, O.
Excelsior Steel Furnace Co., Chicago, Ill.
Gerstein & Cooper Co., South Boston, Mass.
●Henry Furnace & Foundry Co., Cleveland, O.
Jacobs Co., B. & J., Cincinnati, O.
Lamneck Products, Inc., Columbus, O.
Mellish & Murray Co., Chicago, Ill.
Meyer & Bro. Co., F., Peoria, Ill.
Reynolds Corp., New York, N. Y.
Robertson Co. H. H., Pittsburgh, Pa.
●Waterloo Register Co., Waterloo, Ia. (Duct turns).
Zonolite Corp. of Montana, Detroit, Mich.

DUST COLLECTORS

See Collectors, Dust

DUST COUNTERS

See Counters, Dust

EJECTORS, SEWAGE

●American-Marsh Pumps, Inc., Battle Creek, Mich.
Chicago Pump Co., Chicago, Ill.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Economy Pumps, Inc., Chicago, Ill.
●Nash Engineering Co., South Norwalk, Conn.
Quimby Pump Co., Inc., Newark, N. J.
Taber Pump Co., Buffalo, N. Y.
Weil Pump Co., Chicago, Ill.
Yeomans Bros. Co., Chicago, Ill.

ELECTRIC DRILLS

See Drills, Portable, Electric

ELECTRIC MOTORS

See Motors, Electric

ELECTRIC UNIT HEATERS

See Heaters, Unit, Electric

ELECTRODES, ARC WELDING

Air Reduction Sales Co., New York, N. Y.
American Chain & Cable Co., Inc., Bridgeport, Conn.
American Steel & Wire Co., Cleveland, O.
Commonwealth Mfg. Corp., Cincinnati, O.
●General Electric Co., Schenectady, N. Y.
Gulf States Steel Co., Birmingham, Ala.
Keasbey & Mattison Co., Ambler, Pa.
Lincoln Electric Co., Cleveland, O.
Marquette Mfg. Co., Minneapolis, Minn.
Maurath, Inc., Cleveland, O.
Page Steel & Wire Division of American Chain Co., Inc., Monessen, Pa.
Roebling's Sons, John A., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Una Welding, Inc., E. Cleveland, O.
Universal Power Corp., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wilson Welder & Metals Co., Inc., New York, N. Y.

ELIMINATORS, AIR, FOR HEATING SYSTEMS

American Radiator Co., New York, N. Y.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
●Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Illinois Engineering Co., Chicago, Ill.
Maid-O-Mist, Inc., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
●Milwaukee Valve Co., Milwaukee, Wis.
●Sarco Co., Inc., New York, N. Y.
Sterling Engineering Co., Milwaukee, Wis.
●Trane Co., La Crosse, Wis.
Vapor Heating Co., New York, N. Y.
Watson & McDaniel Co., Philadelphia, Pa.
●Webster & Co., Warren, Camden, N. J.

ENAMELS AND LACQUERS

Debevoise Co., Brooklyn, N. Y.
du Pont de Nemours & Co., E. I., Wilmington, Del.
Hilo Varnish Corp., Brooklyn, N. Y.
Maas & Waldstein Co., Newark, N. J.
Wailes Dove-Hermiston Corp., New York, N. Y.
Zapon-Brevolite Div., Atlas Powder Co., North Chicago, Ind

ENGINES, DIESEL

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Locomotive Co., Auburn, N. Y.
Anderson Engine & Foundry Co., Anderson, Ind.
Buda Co., Harvey, Ill.
Caterpillar Tractor Co., Peoria, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.
De La Vergne Engine Co., Philadelphia, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
G.D.S. Machinery & Supply Co., Inc., New York, N. Y.
Hill Diesel Engine Co., Lansing, Mich.
●Ingersoll-Rand, New York, N. Y.
Waukesha Motor Co., Waukesha, Wis.
●Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES, GAS, FOR FAN, PUMP AND COMPRESSOR DRIVES

Chicago Pneumatic Tool Co., New York, N. Y.
Continental Motors Corp., Detroit, Mich.
Fairbanks, Morse & Co., Chicago, Ill.
Lycoming Mfg. Co., Williamsport, Pa.
Universal Motor Co., Oshkosh, Wis.
U. S. Motors Corp., Oshkosh, Wis.
Waukesha Motor Co., Waukesha, Wis.
●Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES, STEAM, FOR FAN, PUMP AND COMPRESSOR DRIVES

Ames Iron Wks., Div. of Pierce Butler Radiator Corp., Oswego, N. Y.
Elliott Co., Jeannette, Pa.
●Frick Co., Waynesboro, Pa.
Harrisburg Fdry. & Mach. Co., Inc., Harrisburg, Pa.
Leffel & Co., James, Springfield, O.
Morris Machine Wks., Baldwinsville, N. Y.
Murray Iron Wks., Co., Burlington, Ia.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Skinner Engine Co., Erie, Pa.
●Sturtevant Co, B. F., Boston, Mass.
Troy Engine & Machine Co., Troy, Pa.
●Vilter Mfg. Co., Milwaukee, Wis.
●Worthington Pump & Machinery Corp., Harrison, N. J.

EVAPORATIVE CONDENSERS

See Condensers, Evaporative

EXCHANGERS, HEAT

Acme Industries, Inc., Jackson, Mich.
●Baker Ice Machine Co., Omaha, Nebr.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Cochrane Corp., Philadelphia, Pa.
Davis Engineering Corp., Elizabeth, N. J.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Filtrine Mfg. Co., Brooklyn, N. Y.
Frank Engineering Co., New York, N. Y.
●Frick Co., Waynesboro, Pa.
General Refrigeration Corp., Beloit, Wis.
Graham Mfg. Co., Buffalo, N. Y.
Griscom-Russell Co., New York, N. Y.
Heat Transfer Co., Huntington, Ind.
Howard Iron Wks. & Alberger Heater Co., Buffalo, N. Y.
●Johnson Fan & Blower Corp., Chicago, Ill.
Kisco Co., Inc., St. Louis, Mo.
Larkin Refrigerating Corp., Atlanta, Ga.
Lewis & Co., Joseph E., Baltimore, Md.
Manufacturers Fin Coil Co., Chicago, Ill.

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McCord Radiator & Mfg. Co., Detroit, Mich.
●National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Richmond Engineering Co., Richmond, Va.
Rome-Turney Radiator Co., Rome, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Sims Co., Erie, Pa.
Super Radiator Corp., Minneapolis, Minn.
●Vilter Mfg. Co, Milwaukee, Wis.
●Westinghouse Electric & Mfg. Co., Mansfield, O.
●Whitlock Coil Pipe Co., Hartford, Conn.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

EXPANSION BENDS

See Bends, Expansion

EXPANSION BOLTS

See Bolts, Expansion

EXPANSION JOINTS

See Joints, Pipe, Expansion

EXPANSION VALVES

See Valves, Refrigerating

FAN BASES

See Bases and Pads, Vibration Isolating

FAN BLADES

See Blades, Fan

FANS, CENTRIFUGAL

Advance Fan & Blower Co., Detroit, Mich.
Air Controls, Inc., Cleveland, O.
Air Devices Corp., Meriden, Conn.
Allen Billmyre Corp., New York, N. Y.
●American Blower Corp., Detroit, Mich.
Ames Co., W. R., San Francisco, Cal.
Arex Co., Chicago, Ill.
●Autovent Fan & Blower Co., Chicago, Ill.
Ballantyne Co., Omaha, Nebr.
Bayley Blower Co., Milwaukee, Wis.
Berns Specialty Co., Chicago, Ill.
Bishop & Babcock Sales Co., Cleveland, O.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., Des Moines, Ia.
Campbell Heating Co., E. K., Kansas City, Mo.
Champion Blower & Forge Co., Lancaster, Pa.
●Clarage Fan Co., Kalamazoo, Mich.
Columbus Heating & Ventilating Co., Columbus, O.
Coppus Engineering Corp., Worcester, Mass.
Davidson Hy Duty Roof Fan Co., Newton, Mass.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Dixie Mfg. Co., Inc., Baltimore, Md.
Duriron Co., Inc., Dayton, O. (Acid resisting).
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Evry-Use Products, Inc., New York, N. Y.
Garden City Fan Co., Chicago, Ill.
General Blower Co., Inc., Philadelphia, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
●Johnson Fan & Blower Corp., Chicago, Ill.
Jordan & Co., Paul R., Indianapolis, Ind.
Lehigh Fan & Blower Co., Allentown, Pa.
Mechanical Air, Little Rock, Ark.
Montag Stove & Furnace Wks., Portland, Ore.
Mountain States Equipment Co., Denver, Colo.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., Minneapolis, Minn.
New York Blower Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Northern Blower Co., Cleveland, O.
Pangborn Corp., Hagerstown, Md.
Peerless Electric Co., Warren, O.
Schwitzer-Cummings Co., Indianapolis, Ind.
Smith Heater Co., Peter, Detroit, Mich.
Spencer Turbine Co., Hartford, Conn.
●Sturtevant Co., B. F., Boston, Mass.
Supreme Heater & Ventilating Corp., St. Louis, Mo.
●Torrington Mfg. Co., Torrington, Conn.
●Trane Co., La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan & Mfg. Co., Los Angeles, Cal.
Viking Air Conditioning Corp., Cleveland, O.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.

FANS, PROPELLER

Aerovent Fan Co., Piqua, O.
Air Controls, Inc., Cleveland, O.
Aircraft Mfg. Co., Dayton, O.
Air Devices Corp., Meriden, Conn.
Airmaster Corp., Chicago, Ill.
Allen Corp., Detroit, Mich.
●American Blower Corp., Detroit, Mich.
American Coolair Corp., Jacksonville, Fla.
Ames Co., W. R., San Francisco, Cal.
Arex Co., Chicago, Ill.
●Autovent Fan & Blower Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Belanger Fan & Blower Co., Detroit, Mich.
Belco Exhaust Fan Mfg. Co., St. Louis, Mo.
Bendix Products Corp., South Bend, Ind.
Berns Specialty Co., Chicago, Ill.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., E. K., Kansas City, Mo.
Champion Blower & Forge Co., Lancaster, Pa.
●Clarage Fan Co., Kalamazoo, Mich.
Coppus Engineering Corp., Worcester, Mass.
Dallas Engineering Co., Dallas, Tex.
Davenport Mfg. Co., Meadville, Pa.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Diehl Mfg. Co., Elizabeth, N. J.
Dixie Mfg. Co., Inc., Baltimore, Md.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Evry-Use Products, Inc., New York, N. Y.
Fresh'nd-Aire Co., Chicago, Ill.
Garden City Fan Co., Chicago, Ill.
General Blower Co., Inc., Philadelphia, Pa.
●General Electric Co., Schenectady, N. Y.
Hartzell Propeller Fan Co., Piqua, O.
●Henry Furnace & Foundry Co., Cleveland, O.
Ilg Electric Ventilating Co., Chicago, Ill.
International Engineering, Inc., Dayton, O.
●Johnson Fan & Blower Corp., Chicago, Ill.
Johnston Co., William W., Dayton, O.
Jordan & Co., Paul R., Indianapolis, Ind.
King Ventilating Co., Owatonna, Minn.
Kisco Co., Inc., St. Louis, Mo.
Mechanical Air, Little Rock, Ark.
Meier Electric & Machine Co., Indianapolis, Ind.
Mountain States Equipment Co., Denver, Colo.
Myers Electric Co., Pittsburgh, Pa.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., Minneapolis, Minn.
New York Blower Co., Chicago, Ill.
Peerless Electric Co., Warren, O. (Disc).
Perkins & Son, Inc., B. F., Holyoke, Mass.
Propellair, Inc., Springfield, O.
Reed Unit-Fans, Inc., New Orleans, La.
Robbins & Myers, Inc., Springfield, O.
Russell Electric Co., Chicago, Ill.
Schwitzer-Cummins Co., Indianapolis, Ind.
●Sturtevant Co., B. F., Boston, Mass.
●Torrington Mfg. Co., Torrington, Conn.
Trane Co., La Crosse, Wis.
Utility Fan & Mfg. Co., Los Angeles, Cal.
Vallen, Inc., Akron, O.
Viking Air Conditioning Corp., Cleveland, O.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.

FEEDERS, WATER, HEATING BOILER

Beaton & Cadwell Mfg. Co., New Britain, Conn.
Cissell Mfg. Co., W. M., Louisville, Ky.
Davis Regulator Co., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Foster Wheeler Corp., New York, N. Y.
Kisco Co., Inc., St. Louis, Mo.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Maid-O-Mist, Inc., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
●Mears-Kane-Ofeldt, Inc., Philadelphia, Pa. (High pressure boiler).
●Milwaukee Valve Co., Milwaukee, Wis.
Mueller Steam Specialty Co., Inc., New York, N. Y.
Nason Co., Detroit, Mich.
Strong, Carlisle & Hammond Co., Cleveland, O.
Thrush & Co., H. A., Peru, Ind.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
●Whitlock Coil Pipe Co., Hartford, Conn.
●Worthington Pump & Machinery Corp., Harrison, N. J.

FIBRE PACKING

See Packing, Fibre

FILTER GAGES

See Gages, Air Filter

FILTERS, AIR, AUTOMATIC

●American Air Filter Co., Inc., Louisville, Ky.
Bubar, Hudson H., New York, N. Y.
Burt Air Filter Corp., New York, N. Y.
Coppus Engineering Corp., Worcester, Mass.
Dracco Corp., Cleveland, O.
Hugo Mfg. Co., West Duluth, Minn.
●Independent Air Filter Co., Chicago, Ill.
Northern Blower Co., Cleveland, O.
●Staynew Filter Corp., Rochester, N. Y.

FILTERS, AIR, UNIT, DRY

●American Air Filter Co., Inc., Louisville, Ky.
Amirton Co., New York, N. Y.
● Annis, Emmett F., Glendale, Cal.
Bubar, Hudson H., New York, N. Y.
Burt Air Filter Corp., New York, N. Y.

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Consolidated Air Conditioning Corp., New York, N. Y. (Odor adsorbers)
Coppus Engineering Corp., Worcester, Mass.
Davies Air Filter Co., New York, N. Y.
Dracco Corp., Cleveland, O.
Greene Gas Cleaner Co., Cleveland, O.
Hugo Mfg. Co., West Duluth, Minn.
●Independent Air Filter Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kleenaire Corp., Stevens Point, Wis.
Somers, Inc., H. J., Detroit, Mich.
●Staynew Filter Corp., Rochester, N. Y.
Universal Air Filter Corp., Duluth, Minn.

FILTERS, AIR, UNIT, VISCOUS

●Air-Maze Corp., Cleveland, O.
●American Air Filter Co., Inc., Louisville, Ky.
American Radiator Co., New York, N. Y.
Bache & Co., Semon, New York, N. Y.
Bubar, Hudson H., New York, N. Y.
●Independent Air Filter Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kleenaire Corp., Stevens Point, Wis.
●Owens-Illinois Glass Co., Newark, O.
Plymouth Cordage Co., N. Plymouth, Mass.
Ripley Co., W. R., Tacoma, Wash.
Wilson & Co., Chicago, Ill.

FILTERS, PIPE LINE

Adams Co., R. P., Buffalo, N. Y.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Cuno Engineering Corp., Meriden, Conn.
Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
Jenkins Bros., New York, N. Y.
Johnson Corp., Three Rivers, Mich.
Norwood Engineering Co., Florence, Mass.
Permutit Co., New York, N. Y.

FINNED TUBING

See Tubing, Finned

FIRE PUMPS

See Pumps, Fire

FITTINGS, COPPER TUBE, COMPRESSION

●American Brass Co., Waterbury, Conn.
American Injector Co., Detroit, Mich.
Chase Brass & Copper Co., Waterbury, Conn.
Colonial Stove Co., Specialties Div., Philadelphia, Pa.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Dole Valve Co., Chicago, Ill.
Dresser Mfg. Co., S. R., Bradford, Pa.
Hays Mfg. Co., Erie, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
●Malleable Iron Fittings Co., Branford, Conn.
Northern Indiana Brass Co., Elkhart, Ind.
Phoenix Brass Fittings, Corp., Irvington, N. J.
Revere Copper & Brass, Inc., New York, N. Y.
●Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Union Metal Wks., Inc., Chelsea, Mass.
Weatherhead Co., Cleveland, O.

FITTINGS, COPPER TUBE, SOLDER

●American Brass Co., Waterbury, Conn.
American Injector Co., Detroit, Mich.
American Radiator Co., New York, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
Northern Indiana Brass Co., Elkhart, Ind.
Revere Copper & Brass, Inc., New York, N. Y.
●Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Union Metal Wks., Inc., Chelsea, Mass.
Weatherhead Co., Cleveland, O.
Wolverine Tube Co., Detroit, Mich.

FITTINGS, LINED

Goodrich Co., B. F., Akron, O. (Rubber)
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead and tin)
National Lead Co., New York, N. Y. (Lead)
Northern Indiana Brass Co., Elkhart, Ind. (Tinned)
Resisto Pipe & Valve Co., East Cambridge, Mass.
United States Rubber Products, Inc., New York, N. Y. (Rubber)

FITTINGS, PIPE, BRASS, SOLDER

Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Grabler Mfg. Co., Cleveland, O.
Imperial Brass Mfg. Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
Northern Indiana Brass Co., Elkhart, Ind.
●Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Union Metal Wks., Inc., Chelsea, Mass.
●Walworth Co., New York, N. Y. (Brazed)
Wolverine Tube Co., Detroit, Mich.

FITTINGS, PIPE, BRASS, THREADED

Acheson Mfg. Co., Rankin, Pa.
American Manganese Bronze Co., Philadelphia, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
General Fittings Co., Providence, R. I.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Mfg. Co., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
New York Brass Fdry., New York, N. Y.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Phoenix Brass Fittings Corp., Irvington, N. J.
Pittsburgh Valve & Fittings Corp., Barberton, O.
●Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Union Metal Wks., Inc., Chelsea, Mass.
●Walworth Co., New York, N. Y.
Weatherhead Co., Cleveland, O.

FITTINGS, PIPE, BRASS, WELDING

●Bonney Forge & Tool Wks., Allentown, Pa.
●Tube-Turns, Inc., Louisville, Ky.

FITTINGS, PIPE, CAST IRON

American Cast Iron Pipe Co., Birmingham, Ala.
Clow, Jas. B. & Sons, Chicago, Ill.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill. (Steam-jacketed)
Devlin Mfg. Co., Thos., Burlington, N. J.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
●Kuhns Bros. Co., Dayton, O.
Lumsden Van Stone Co., South Boston, Mass.
Lunkenheimer Co., Cincinnati, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Semler Co., Jeannette, Pa.
Stockham Pipe & Fittings Co., Birmingham, Ala.
●Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

FITTINGS, PIPE, LEAD

Andrews Lead Co., Inc., Long Island City, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Iong Island City, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.

FITTINGS, PIPE, MALLEABLE

Colonial Stove Co., Specialties Div., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Devlin Mfg. Co., Thos., Burlington, N. J.
Dresser Mfg. Co., S. R., Bradford, Pa.
Duriron Co., Inc., Dayton, O. (Acid-resisting)
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
General Fittings Co., Providence, R. I.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
●Malleable Iron Fittings Co., Branford, Conn.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Stockham Pipe & Fittings Co., Birmingham, Ala.
●Walworth Co., New York, N. Y.
Ward Foundry, Inc., J. P., Blossburg, Pa.

FITTINGS, PIPE, STEEL, FLANGED

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
Central Forging Co., Catawissa, Pa.
Colonial Stove Co., Specialties Div., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Thos., Burlington, N. J.
Lumsden Van Stone Co., South Boston, Mass.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Semet-Solvay Engrg. Corp., New York, N. Y.
Taylor Forge & Pipe Wks., Chicago, Ill.
Vogt Machine Co., Henry, Louisville, Ky.
●Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.

●Advertisement in this issue. See Index to Advertisers, page 232.

FITTINGS, PIPE, STEEL, THREADED

Alloy Steel Products Co., Linden, N. J. (Stainless steel).
●Bonney Forge & Tool Wks., Allentown, Pa.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Thos., Burlington, N. J.
Laclede Steel Co., St. Louis, Mo.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Vogt Machine Co., Henry, Louisville, Ky.
●Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.

FITTINGS, PIPE, STEEL, WELDING

●Bonney Forge & Tool Wks., Allentown, Pa.
●Crane Co., Chicago, Ill.
●Grinnell Co., Inc., Providence, R. I.
Larkin Packer Co., St. Louis, Mo.
●Midwest Piping & Supply Co., St. Louis, Mo.
Oil Well Supply Co., Oil City, Pa.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Semet-Solvay Engineering Corp., New York, N. Y.
Taylor Forge & Pipe Wks, Chicago, Ill.
●Tube-Turns, Inc., Louisville, Ky.
●Walworth Co., New York, N. Y.
Wedge Protectors, Inc., Cleveland, O. (Chill rings)

FITTINGS, PIPE, WROUGHT IRON, WELDING

●Bonney Forge & Tool Wks., Allentown, Pa.
●Grinnell Co., Inc., Providence, R. I.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Taylor Forge & Pipe Wks, Chicago, Ill.
●Walworth Co., New York, N. Y.

FITTINGS, REFRIGERATION

●Baker Ice Machine Co., Inc., Omaha, Nebr.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Chase Brass & Copper Co., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
●Electrimatic Corp., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
●Henry Valve Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kerotest Mfg. Co., Pittsburgh, Pa.
Perfection Refrigeration Parts Co., Harvey, Ill.
Triumph Ice Machine Co., Cincinnati, O.
●Vilter Mfg. Co., Henry, Louisville, Ky.
Vogt Machine Co., Henry, Louisville, Ky.
Weatherhead Co., Cleveland, O.
Wittenmeier Machinery Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
X L Refrigerating Co., Inc., Chicago, Ill.

FLANGE BOLTS

See Bolts and Studs, Flange

FLANGES, PIPE

American Cast Iron Pipe Co., Birmingham, Ala.
●American District Steam Co., North Tonawanda, N. Y.
Blaw-Knox Co., Blawnox, Pa.
Clow, Jas. B. & Sons, Chicago, Ill.
●Crane Co., Chicago, Ill.
●Dart Mfg. Co., E. M., Providence, R. I.
Devlin Mfg. Co., Thos., Burlington, N. J.
●Grinnell Co., Inc., Providence, R. I.
Harrisburg Steel Corp., Harrisburg, Pa.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Mfg. Co., New York, N. Y. (Brass only)
Kennedy Valve Mfg. Co., Elmira, N. Y.
●Kuhns Bros. Co., Dayton, O.
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden Van Stone Co., South Boston, Mass.
●Midwest Piping & Supply Co., St. Louis, Mo.
National Valve & Mfg. Co., Pittsburgh, Pa.
Pennsylvania Forge Co., Philadelphia, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Pittsburgh Valve Foundry & Construction Co., Pittsburgh, Pa.
Power Piping Co., Pittsburgh, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Semler Co., Jeannette, Pa.
Steel Improvement & Forge Co., Cleveland, O.
Taylor Forge & Pipe Wks., Chicago, Ill.
Vogt Machine Co., Henry, Louisville, Ky.
●Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

FLEXIBLE COUPLINGS

See Couplings, Flexible

FLEXIBLE METAL HOSE

See Hose, Metal, for Eliminating Compressor Vibration

FLOATS, STEAM TRAP, ETC.

Clark Controller Co., Cleveland, O.
Fisher Governor Co., Marshalltown, Ia.
Harris & Co., Arthur, Chicago, Ill.
Hercules Float Wks., Springfield, Mass.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
McAlear Mfg. Co., Chicago, Ill.
Naugatuck Mfg. Co., Union City, Conn.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Reichert Float & Mfg. Co., Toledo, O.
Reliance Gauge Column Co., Cleveland, O.
Sterling Engineering Co., Milwaukee, Wis.
Strong, Carlisle & Hammond Co., Cleveland, O.
Watson & McDaniel Co., 440 N. Marshall, Philadelphia, Pa.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

FLOAT SWITCHES

See Switches, Float

FLOAT VALVES

See Valves, Float

FLOOR AND CEILING PLATES

See Plates, Floor and Ceiling

FLOW METERS

See Meters, Flow

FORGED STEEL VALVES

See Valves, Forged Steel

FURNACES, WARM AIR, FOR INDUSTRIAL AND LARGE BUILDING HEATING

Acme Heating & Ventilating Co., Inc., Chicago, Ill.
●Airtherm Mfg. Co., St. Louis, Mo.
American Foundry & Furnace Co., Bloomington, Ill.
Campbell Heating Co., Des Moines, Ia.
Campbell Heating Co., E. K., Kansas City, Mo.
Forest City Foundries Co., Cleveland, O.
Hart & Crouse Co., Inc., Utica, N. Y.
●Henry Furnace & Foundry Co., Cleveland, O.
International Heater Co., Utica, N. Y.
Jackson & Church Co., Saginaw, Mich.
Lee Heating Systems, Youngstown, O.
Lennox Furnace Co., Marshalltown, Ia., and Syracuse, N. Y.
Magiri Foundry & Furnace Wks., P. H. Bloomington, Ill.
Moncrief Furnace Co., Atlanta, Ga.
Montag Stove & Furnace Wks., Portland, Ore.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Nelson Co., Detroit, Mich.
New York Blower Co., Chicago, Ill.
Nugent Sons, Inc., Thos., New York, N. Y.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Reif-Rexoil, Inc., Buffalo, N. Y.
Ross Engineering Corp., J. O., New York, N. Y.
Smith, Inc., James Campbell, Cleveland, O.
Spear Stove & Heating Co., James, Philadelphia, Pa.
Surface Combustion Corp., Toledo, O.
Thatcher Co., Newark, N. J.
Western Furnaces, Inc., Tacoma, Wash.
XXth Century Heating & Ventilating Co., Akron, O.

GAGES, AIR FILTER

Ellison Draft Gage Co., Chicago, Ill.
Friez & Sons, Inc., Julien P., Baltimore, Md.
Hays Corp., Michigan City, Ind.
●Hill, E. Vernon, Chicago, Ill.

GAGES, INDICATING, DRAFT

Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Crew-Sargent Controls, Inc., New York, N. Y.
Defender Automatic Regulator Co., St. Louis, Mo.
Ellison Draft Gage Co., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Inc., Julien P., Baltimore, Md.
Hays Corp., Michigan City, Ind.
●Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Moeller Instrument Co., Richmond Hill, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Spence Engrg. Co., Inc., Walden, N. Y.
Uehling Instrument Co., Paterson, N. J.

GAGES, INDICATING, PRESSURE

Anderson Products, Inc., Cambridge, Mass.
Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Belfield Co., H., Philadelphia, Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
●Bristol Co., Waterbury, Conn.

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Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
●Crane Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Inc., Julien P., Baltimore, Md.
Hays Corp., Michigan City, Ind.
●Hill, E. Vernon, Chicago, Ill.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Lonergan Co., J. E., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Moeller Instrument Co., Richmond Hill, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Russell & Co., W. A., New York, N. Y.
Star Brass Mfg. Co., Boston, Mass.
Sterling Engineering Co., Milwaukee, Wis.
Taylor Instrument Companies, Rochester, N. Y.
●Trane Co., La Crosse, Wis.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

GAGES, INDICATING, VACUUM

Anderson Products, Inc., Cambridge, Mass.
Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Belfield Co., H., Philadelphia, Pa.
●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Dole Valve Co., Chicago, Ill.
●Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Inc., Julien P., Baltimore, Md.
●General Electric Co., Schenectady, N. Y.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Lonergan Co., J. E., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Moeller Instrument Co., Richmond Hill, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Russell & Co., W. A., New York, N. Y.
Star Brass Mfg. Co., Boston, Mass.
Sterling Engineering Co., Milwaukee, Wis.
Taylor Instrument Companies, Rochester, N. Y.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

GAGES, LIQUID LEVEL

●Bristol Co., Waterbury, Conn.
Boston Auto Gage Co., Pittsfield, Mass.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Caldwell Co., W. E. Louisville, Ky.
●Crane Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Diamond Power Specialty Co., Detroit, Mich.
Foxboro Co., Foxboro, Mass.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
King-Seeley Corp., Ann Arbor, Mich.
Klingerit, Inc., New York, N. Y.
Liquidometer Corp., Long Island City, N. Y.
Lonergan Co., J. E., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Nason Co., Detroit, Mich.
Petrometer Corp., Long Island City, N. Y.
Reliance Gauge Column Co., Cleveland, O.
Republic Flow Meters Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Scientific Instrument Co., Detroit, Mich.
Taylor Instrument Companies, Rochester, N. Y.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.
Viking Pump Co., Cedar Falls, Ia.
Wright-Austin Co., Detroit, Mich.
●Yarnall-Waring Co., Philadelphia, Pa.

GALVANIZED SHEETS

See Sheets, Iron and Steel, Galvanized

GAS BURNERS

See Burners, Gas

GAS ENGINES

See Engines, Gas

GAS PRESSURE REGULATORS

See Regulators, Pressure, Gas

GASKETS

Akron Metallic Gasket Co., Akron, O. (Metal & metal asbestos)
Anchor Packing Co., Philadelphia, Pa. (Asbestos)
●Armstrong Cork Products Co., Lancaster, Pa. (Cork & cork composition)
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Chicago-Wilcox Mfg. Co., Chicago, Ill.
Continental Diamond Fibre Co., Newark, Del.
Continental Rubber Wks., Erie, Pa.
Crandall Packing Co., Palmyra, N. Y. (Asbesto, rubber)
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y. (Asbestos)
Durabla Mfg. Co., New York, N. Y. (Asbestos fibre)
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Endura Mfg. Corp., Quakertown, Pa. (Paper, fibre)
Felt Products Mfg. Co., Chicago, Ill.
Flexitallic Gasket Co., Camden, N. J. (Metal, asbestos)
●Frick Co., Waynesboro, Pa.
Garlock Packing Co., Palmyra, N. Y. (Rubber, asbestos, fibre, semi-metallic)
Gatke Corp., Chicago, Ill.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Goodrich Co., B. F., Akron, O.
Graton & Knight Co., Worcester, Mass. (Leather)
Jenkins Bros., New York, N. Y. (Ring asbestos or rubber sheet)
Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
Klingerit, Inc., New York, N. Y.
Metallo Gasket Co., New Brunswick, N. J. (Metal, metal asbestos)
National Boiler Improvement Co., Washington, D. C.
Ruberoid Co., New York, N. Y. (Asbestos)
Smooth-On Mfg. Co., Jersey City, N. J.
Stokes Rubber Co., Jos., Trenton, N. J. (Hard rubber)
United States Rubber Products, Inc., New York, N. Y. (Rubber, asbestos)
Western Felt Wks., Chicago, Ill. (Felt)
●Wilson, Inc., Grant, Chicago, Ill. (Asbestos).

GATE VALVES

See Valves, Gate

GLASS PIPE

See Pipe, Glass

GLOBE VALVES

See Valves, Globe

GOVERNORS, PUMP

Bailey Meter Co., Cleveland, O.
Boylston Steam Specialty Co., Chicago, Ill.
Burrows Mfg. Co., F. A., York, Pa.
Cash Co., A. W., Decatur, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
●Dunham Co., C. A., Chicago, Ill.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Gardner-Denver Co., Quincy, Ill.
●Illinois Engineering Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
Northern Equipment Co., Erie, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schwitzer-Cummins Co., Indianapolis, Ind.
Spence Engineering Co., Inc., Walden, N. Y.
Squires Co., C. E., Cleveland, O.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

GRILLES

Aircraft Mfg. Co., Dayton, O.
●American Blower Corp., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American Warming & Ventilating Co., Toledo, O.
●Anemostat Corp. of America, New York, N. Y. (High velocity air diffusers)
●Auer Register Co., Cleveland, O.
●Barber-Colman Co., Rockford, Ill.
Best Register Co., Milwaukee, Wis.
Campbell Heating Co., Des Moines, Ia.
Campbell Heating Co., E. K., Kansas City, Mo.
Cross Engineering Co., Carbondale, Pa.
Diamond Mfg. Co., Wyoming, Pa.
Erdle Perforating Co., Rochester, N. Y.

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Gillian Mfg. Co., Ferndale, Mich.
Globe Machine & Stamping Co., Cleveland, O.
Harrington & King Perforating Co., Chicago, Ill.
Hart & Cooley Mfg. Co., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
●Independent Register Co., Cleveland, O.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Knowles Mushroom Ventilator Co., New York, N. Y.
Metalace Corp., So. Boston, Mass.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Register & Grille Mfg. Co., Brooklyn, N. Y.
Rock Island Register Co., Rock Island, Ill.
●Trane Co., La Crosse, Wis.
●Tuttle & Bailey, Inc., New Britain, Conn.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
United States Register Co., Battle Creek, Mich.
●Waterloo Register Co., Waterloo, Ia.
●Wickwire Spencer Steel Co., New York, N. Y.

GUNS AND POTS, SMOKE AND SMUDGE, FOR TESTING AIR MOVEMENT

●Hill, E. Vernon, Chicago, Ill.
Pains Fireworks Display Co., New York, N. Y.

HAND SHEARS

See Shears, Hand

HANGERS OR BRACKETS, RADIATOR

American Foundry & Furnace Co., Bloomington, Ill.
American Radiator Co., New York, N. Y.
Carpenter & Paterson, Inc., East Boston, Mass.
Carty & Moore Engineering Co., Detroit, Mich.
Chicago Nipple Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Hartmann Co., Chas., Brooklyn, N. Y.
Healy Ruff Co., St. Paul, Minn.
Inland Mfg. Co., Chicago, Ill. (Unit heater hangers)
Jennison Co., Fitchburg, Mass. (Adjustable radiator foot rest)
Logansport Radiator Equipment Co., Logansport, Ind.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Paine Co., Chicago, Ill.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Sterling Engineering Co., Milwaukee, Wis.
United States Radiator Corp., Detroit, Mich.
Western Hanger Co., San Francisco, Cal.

HANGERS AND SUPPORTS, PIPE

Beaton & Cadwell Mfg. Co., New Britain, Conn.
Carpenter & Paterson, Inc., East Boston, Mass.
Chicago Nipple Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Farley Sleeve & Hanger Co., Cleveland, O.
Globe Machine & Stamping Co., Cleveland, O.
Grabler Mfg. Co., Cleveland. O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Lumsden Van Stone Co.. South Boston, Mass.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
Paine Co., Chicago, Ill.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Reznor Mfg. Co., Mercer, Pa.
●Ric-wiL Co., Cleveland, O. (Underground)
Rockwood Sprinkler Co., Worcester, Mass.
Roessing Mfg. Co., Pittsburgh, Pa.
Semler Co., Jeannette, Pa.
●Walworth Co., New York, N. Y.
Western Wire Products Co., St. Louis, Mo.

HARD RUBBER PIPE

See Pipe, Hard Rubber

HEADERS, WELDED

Blaw-Knox Co., Blawnox, Pa.
Columbian Steel Tank Co., Kansas City, Mo.
●Crane Co., Chicago, Ill.
Floersheim & Co., B., Pittsburgh. Pa.
●Grinnell Co.. Inc., Providence, R. I.
International Engineering Wks., Inc., Framingham, Mass.
Kellogg Co., M. W., The, New York, N. Y.
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden Van Stone Co., South Boston, Mass.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
●National Pipe Bending Co., New Haven, Conn.
National Valve & Mfg. Co., Pittsburgh, Pa.
Ohio Pipe Bending & Mach. Co., Cleveland, O.
Parks-Cramer Co., Fitchburg. Mass.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
Pittsburgh Pipe Coil & Bending Co., Etna, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Power Piping Co., Pittsburgh, Pa.
●Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Semet-Solvay Engineering Corp., New York N. Y.
Shaw Co., Benjamin F., Wilmington, Del.
●Walworth Co., New York, N. Y.

HEADS, SPRINKLER

Cleghorn Co., Boston, Mass.
●Grinnell Co., Inc., Providence, R. I.
Hodgman Mfg. Co., Taunton, Mass.
Raisler Sprinkler Co., New York, N. Y.
Rockwood Sprinkler Co., Worcester, Mass.

HEAT EXCHANGERS

See Exchangers, Heat

HEATERS, AIR, DIRECT FIRED

●Airtherm Mfg. Co., St. Louis, Mo.
Bryant Heater Co., Cleveland, O.
Dravo Corp., Pittsburgh, Pa.
Jackson & Church Co., Saginaw, Mich.
Lee Heating Systems, Youngstown, O.
Magirl Foundry & Furnace Wks., P. H., Bloomington, Ill.
Nelson Co., Detroit, Mich.
New York Blower Co., Chicago, Ill.
Ross Engineering Corp., J. O., New York, N. Y.
Smith, Inc., James Campbell, Cleveland, O.
Williams, Inc., F. C., Dearborn, Mich.

HEATERS, DUCT, ELECTRIC

●General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Philadelphia, Pa.
Trent Co., Harold E., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, SPACE, ELECTRIC

●Burnham Boiler Corp., Irvington, N. Y.
Cutler-Hammer, Inc., Milwaukee, Wis.
Electric Air Heater Co., Div. American Foundry Equipment Co., Mishawaka, Ind.
●General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Philadelphia, Pa.
Trent Co., Harold E., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, STRIP AND IMMERSION, ELECTRIC

Cutler-Hammer, Inc., Milwaukee, Wis.
Electro Hot Heater Co., Tacoma, Wash.
●General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Philadelphia, Pa.
Swoboda, Inc., H. O., New Brighton, Pa. (For pre-heating and stress relieving welded seams).
Trent Co., Harold E., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, UNIT, ELECTRIC

Air Devices Corp., Meriden, Conn.
●Autovent Fan & Blower Co., Chicago, Ill.
Berns Specialty Co., Chicago, Ill.
Electric Air Heater Co., Div. American Foundry Equipment Co., Mishawaka, Ind.
Electro Hot Heater Co., Tacoma, Wash.
●Grinnell Co., Inc., Providence, R. I.
Hexcel Radiator Co., Racine, Wis.
Hynes Electric Heating Co., Philadelphia, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., Minneapolis, Minn.
●Sturtevant Co., B. F., Boston, Mass.
Trent Co., Harold E., Philadelphia, Pa.
Warren Electric Appliance Co., Warren, Pa.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, UNIT, GAS FIRED

Bryant Heater Co., Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., E. K., Kansas City, Mo.
Colonial Stove Co., Specialties Div., Philadelphia, Pa.
Continental Stove Corp., Ironton, O.
General Gas Light Co., Kalamazoo, Mich.
Lee Heating Systems, Youngstown, O.
Mueller Furnace Co., L. J., Milwaukee, Wis.
National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., Minneapolis, Minn.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Reznor Mfg. Co., Mercer, Pa.
Ross Engineering Corp., J. O., New York, N. Y.
Schoedinger, F. O., Columbus, O.
Surface Combustion Corp., Toledo, O.

HEATERS, UNIT, STEAM AND HOT WATER

Air Devices Corp, Meriden, Conn.
●Airtherm Mfg. Co., St. Louis, Mo.
●American Blower Corp, Detroit, Mich.
Arex Co., Chicago, Ill.
●Autovent Fan & Blower Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Beacon-Morris Corp., Boston, Mass.

● Advertisement in this issue. See Index to Advertisers, page 232.

- Berns Specialty Co., Chicago, Ill.
- Bishop & Babcock Sales Co., Cleveland, O.
- Blower Application Co., Milwaukee, Wis.
- ●Buffalo Forge Co., Buffalo, N. Y.
- ●Burnham Boiler Corp., Irvington, N. Y.
- Campbell Heating Co., E. K., Kansas City, Mo.
- Carrier Corp., Syracuse, N. Y.
- ●Clarage Fan Co., Kalamazoo, Mich.
- Davidson Hy Duty Roof Fan Co., Newton, Mass.
- ●Dunham Co., C. A., Chicago, Ill.
- Electrovent Fan & Mfg. Co., Chicago, Ill.
- ●Fedders Mfg. Co., Buffalo, N. Y.
- ●Grinnell Co., Inc., Providence, R. I.
- Hartzell Propeller Fan Co., Piqua, O.
- Ilg Electric Ventilating Co., Chicago, Ill.
- ●Johnson Fan & Blower Corp., Chicago, Ill.
- King Ventilating Co., Owatonna, Minn.
- Kisco Co., Inc., St. Louis, Mo.
- Manufacturers Fin Coil Co., Chicago, Ill.
- Mayflower-Lewis Corp., St. Paul, Minn.
- McCord Radiator & Mfg. Co., Detroit, Mich.
- ●McQuay, Inc., Minneapolis, Minn.
- Modine Mfg. Co., Racine, Wis.
- Murray Iron Wks. Co., Burlington, Ia.
- National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., Minneapolis, Minn.
- National Radiator Corp., Johnstown, Pa.
- Nelson Corp., Herman, Moline, Ill.
- ●Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
- New York Blower Co., Chicago, Ill.
- Niagara Blower Co., New York, N. Y.
- Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
- Rome-Turney Radiator Co., Rome, N. Y.
- ●St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
- Steamaire Co., Cincinnati, O.
- ●Sturtevant Co., B. F., Boston, Mass.
- Thermal Units Mfg. Co., Meriden, Conn.
- ●Trane Co., La Crosse, Wis.
- Trenton Auto Radiator Wks., Trenton, N. J.
- ●Unit Heater & Cooler Co., Wausau, Wis.
- United States Radiator Corp., Detroit, Mich.
- ●U. S. Air Conditioning Corp., Minneapolis, Minn.
- Western Blower Co., Seattle, Wash.
- ●Wing Mfg. Co., L. J., New York, N. Y.
- ●Young Radiator Co., Racine, Wis.

HEATERS, WATER, CAST IRON, COAL FIRED

- American Radiator Co., New York, N. Y.
- ●Burnham Boiler Corp., Irvington, N. Y.
- Central Radiator Co., New York, N. Y.
- Cleghorn Co., Boston, Mass.
- ●Crane Co., Chicago, Ill.
- Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
- Glore Sales Corp., Evins F., New York, N. Y.
- Hart & Crouse Co., Inc., Utica, N. Y.
- International Heater Co., Utica, N. Y.
- Molby Boiler Co., New York, N. Y.
- Mueller Furnace Co., L. J., Milwaukee, Wis.
- ●National Pipe Bending Co., New Haven, Conn.
- National Radiator Corp., Johnstown, Pa.
- Peerless Heater Co., Boyertown, Pa.
- Pierce, Butler Radiator Corp., Syracuse, N. Y.
- Prox Co., Frank, Terre Haute, Ind.
- Richardson & Boynton Co., New York, N. Y.
- Smith Co., H. B., Westfield, Mass.
- Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa.
- Thatcher Co., Newark, N. J.
- Weil-McLain Co., Chicago, Ill.

HEATERS, WATER, GAS OR OIL FIRED

- American Gas Products Co., New York, N. Y.
- Bryant Heater Co., Cleveland, O.
- Colonial Stove Co., Specialties Div., Philadelphia, Pa.
- ●Crane Co., Chicago, Ill.
- Dahlquist Mfg. Co., Inc., Boston, Mass.
- Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
- Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
- Electrol, Inc., Clifton, N. J.
- Gilbert & Barker Mfg. Co., Springfield, Mass.
- International Engineering Wks., Inc., Framingham, Mass.
- Johnson Co., S. T., Oakland, Cal.
- Kleen-Heet, Inc., Chicago, Ill.
- ●Kewanee Boiler Corp., Kewanee, Ill.
- Lookout Boiler & Mfg. Co., Chattanooga, Tenn.
- ●Mears-Kane Ofeldt, Inc., Philadelphia, Pa.
- Mueller Furnace Co., L. J., Milwaukee, Wis.
- National Radiator Corp., Johnstown, Pa.
- Norge Heating & Conditioning Div., Borg-Warner Corp., Detroit, Mich.
- Nu-Way Corp., Rock Island, Ill.
- Pittsburgh Water Heater Co., Pittsburgh, Pa.
- Reif-Rexoil, Inc., Buffalo, N. Y.
- Richardson & Boynton Co., New York, N. Y.
- Rotary Mfg. Co., Los Angeles, Cal.
- Ruud Mfg. Co., Los Angeles, Cal.
- Surface Combustion Corp., Toledo, O.
- United American Bosch Corp., Springfield, Mass.
- United States Radiator Corp., Detroit, Mich.
- Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
- Wood Industries, Inc., Gar., Detroit, Mich.
- York Oil Burner Co., Inc., York, Pa.

HEATERS, WATER, INDIRECT

- Adams Engineering Co., Chicago, Ill.
- Akwa Heaters, Inc., New York, N. Y.
- Automatic Stoker Corp., Milwaukee, Wis.
- ●Bell & Gossett Co., Chicago, Ill.
- Bryan Steam Corp., Peru, Ind.
- Croll-Reynolds Engineering Co., Inc., New York, N. Y.
- Davis Engineering Corp., Elizabeth, N. J.
- Excelso Products Corp., Buffalo, N. Y.
- Ferguson & Lange Foundry Co., Chicago, Ill.
- General Fittings Co., Providence, R. I.
- Little Mfg. Co., M. S., Hartford, Conn.
- Marion Machine Foundry & Supply Co., Marion, Ind.
- ●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
- Richmond Engineering Co., Richmond, Va.
- Riverside Boiler Wks., Inc., Cambridge, Mass.
- Sterling Engineering Co., Milwaukee, Wis.
- Stevens-Root Co., Chicago, Ill.
- Taco Heaters, Inc., New York, N. Y.
- Watts Regulator Co., Lawrence, Mass.

HEATERS, WATER, STEAM, INSTANTANEOUS

- Davis Engineering Corp., Elizabeth, N. J.
- Eclipse Fuel Engineering Co., Rockford, Ill.
- General Fittings Co., Providence, R. I.
- Graham Mfg. Co., Buffalo, N. Y.
- Griscom-Russell Co., New York, N. Y.
- Hasco Valve & Machine Co., Milwaukee, Wis.
- Howard Iron Wks. & Alberger Heater Co., Buffalo, N. Y.
- Johnson Corp., Three Rivers, Mich.
- Kisco Co., Inc., St. Louis, Mo.
- Marion Machine Foundry & Supply Co., Marion, Ind.
- ●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
- Richmond Engineering Co., Richmond, Va.
- Sims Co., Erie, Pa.
- Sterling Engineering Co., Milwaukee, Wis.
- Taco Heaters, Inc., New York, N. Y.
- ●Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, WATER, STEEL, COAL FIRED

- Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
- Fitzgibbons Boiler Co., New York, N. Y.
- International Engineering Wks., Inc., Framingham, Mass.
- Johnston Bro., Inc., Ferrysburg, Mich.
- ●Kewanee Boiler Corp., Kewanee, Ill.
- Lookout Boiler & Mfg. Co., Chattanooga, Tenn.
- National Radiator Corp., Johnstown, Pa.
- Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa

HEATERS, WATER, STORAGE

- ●American District Steam Co., North Tonawanda, N. Y.
- Bigelow Co., New Haven, Conn.
- Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
- Bryant Heater Co., Cleveland, O.
- ●Burnham Boiler Corp., Irvington, N. Y.
- Chase Brass & Copper Co., Waterbury, Conn.
- Cleghorn Co., Boston, Mass.
- ●Crane Co., Chicago, Ill.
- Dahlquist Mfg. Co., Inc., Boston, Mass.
- Davis Engineering Corp., Elizabeth, N. J.
- Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
- Frank Engineering Co., New York, N. Y.
- General Fittings Co., Povidence, R. I.
- Gerstein & Cooper Co., South Boston, Mass.
- Griscom-Russell Co., New York, N. Y.
- Hotstream Heater Co., Cleveland, O.
- Howard Iron Wks. & Alberger Heater Co., Buffalo, N. Y.
- Hynes Electric Heating Co., Philadelphia, Pa.
- International Engineering Wks., Inc., Framingham, Mass.
- Johnson Corp., Three Rivers, Mich.
- ●Kewanee Boiler Corp., Kewanee, Ill.
- Manitowoc Boiler Wks., Manitowoc, Wis.
- ●Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
- Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
- Mueller Furnace Co., L. J., Milwaukee, Wis.
- ●National Pipe Bending Co., New Haven, Conn.
- National Radiator Corp., Johnstown, Pa.
- ●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
- Richmond Engineering Co., Richmond, Va.
- Riverside Boiler Wks., Inc., Cambridge, Mass.
- Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
- Rotary Mfg. Co., Los Angeles, Cal.
- Sims Co., Erie, Pa.
- Taco Heaters, Inc., New York, N. Y.
- Vogt Machine Co., Henry, Louisville, Ky.
- Warren Electric Appliance Co., Warren, Pa. (Electric)
- Whitehead Metal Products Co. of New York, Inc., New York, N. Y.
- ●Whitlock Coil Pipe Co., Hartford, Conn.

HEATING BOILERS

See Boilers, Heating

HEATING COILS

See Surface, Heating

HEATING SURFACE

See Surface, Heating

●Advertisement in this issue. See Index to Advertisers, page 232.

HOSE, METAL, FOR ELIMINATING COMPRESSOR VIBRATION

●American Metal Hose Branch, American Brass Co., Waterbury, Conn.
●Chicago Metal Hose Corp., Maywood, Ill.
Eclipse Aviation Corp., East Orange, N. J.
Seamlex Co., Long Island City, N. Y.
Titeflex Metal Hose Co., Newark, N. J.
United Metal Hose Co., Inc., Long Island City, N. Y.

HOT WATER HEATING SYSTEMS

See Systems, Heating, Hot Water

HOT WATER PRESSURE REGULATORS

See Regulators, Pressure, Hot Water Heating Systems

HUMIDIFIERS, CENTRAL PLANT

●Armstrong Machine Wks., Three Rivers, Mich.
●Barber-Colman Co., Rockford, Ill.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
●Powers Regulator Co., Chicago, Ill.

HUMIDIFIERS, DIRECT, SPRAY HEAD

American Moistening Co., Providence, R. I.
Ames Co., W. R., San Francisco, Cal.
Anetsberger Bros., Chicago, Ill.
Bahnson Co., Winston-Salem, N. C.
Betz Unit Air Cooler Co., Kansas City, Mo.
●Binks Mfg. Co., Chicago, Ill.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., E. K., Kansas City, Mo.
Carrier Corp., Syracuse, N. Y.
International Moistening Co., Providence, R. I.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Manufacturers Machine Co., North Andover, Mass.
●Marley Co., Kansas City, Mo.
Mayflower-Lewis Corp., St. Paul, Minn.
●McQuay, Inc., Minneapolis, Minn.
Mellish & Murray Co., Chicago, Ill.
Montag Stove & Furnace Wks., Portland, Ore.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Murray Mfg. Co., D. J., Wausau, Wis.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Nugent Sons, Inc., Thos., New York, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Pfening Co., Fred D., Columbus, O.
Rega Mfg. Co., Rochester, N. Y.
Rhode Island Humidifier & Ventilating Co., Boston, Mass.
Ross Sprinkler Co., Pasadena, Cal.
Schwitzer-Cummins Co., Indianapolis, Ind.
Somers, Inc., H. J., Detroit, Mich.
Southworth Machine Co., Portland, Me.
Steamaire Co., Cincinnati, O.
Thermal Units Mfg. Co., Meriden, Conn.
Utility Fan & Mfg. Co., Los Angeles, Cal.

HUMIDIFIERS, UNIT, ROOM TYPE (Without Heating)

American Moistening Co., Providence, R. I.
Bahnson Co., Winston-Salem, N. C.
Betz Unit Air Cooler Co., Kansas City, Mo.
Bryant Heater Co., Cleveland, O.
●Clarage Fan Co., Kalamazoo, Mich.
Corozone Air Conditioning Corp., Cleveland, O.
Hugo Mfg. Co., Duluth, Minn.
International Moistening Co., Providence, R. I.
Mayflower-Lewis Corp., St. Paul, Minn.
Pamco Conditionaire Co., Chicago, Ill.
Parks-Cramer Co., Fitchburg, Mass.
Pfening Co., Fred D., Columbus, O.
Sheer Co., H. M., Quincy, Ill.
Somers, Inc., H. J., Detroit, Mich.
Southworth Machine Co., Portland, Me.
Standard Engineering Wks., Pawtucket, R. I.
United American Bosch Corp., Springfield, Mass.
Vigor-Aire Corp., Philadelphia, Pa.

HUMIDISTATS

American Moistening Co., Providence, R. I.
●Automatic Products Co., Milwaukee, Wis.
Bahnson Co., Winston-Salem, N. C.
●Barber-Colman Co., Rockford, Ill.
●Bristol Co., Waterbury, Conn.
●Detroit Lubricator Co., Detroit, Mich.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Inc., Julien P., Baltimore, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
●Johnson Service Co., Milwaukee, Wis.
Johnson Tool Co., Inc., East Providence, R. I.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
Ripley Co., W. R., Tacoma, Wash.
Somers, Inc., H. J., Detroit, Mich.
Spencer Thermostat Co., Attleboro, Mass.
Standard Engineering Wks., Pawtucket, R. I.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.

HUMIDITY RECORDERS

See Recorders, Humidity

HYDRAULIC PUMPS

See Pumps, Hydraulic

HYGROMETERS

American Moistening Co., Providence, R. I.
Bahnson Co., Winston-Salem, N. C.
●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Fee and Stemwedel, Inc., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Inc., Julien P., Baltimore, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
●Hill, E. Vernon, Chicago, Ill.
International Moistening Co., Providence, R. I.
●Johnson Service Co., Milwaukee, Wis.
Johnson Tool Co., East Providence, R. I.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Mayflower-Lewis Corp., St. Paul, Minn.
Moeller Instrument Co., Richmond Hill, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Palmer Co., Cincinnati (Norwood), O.
Scientific Instrument Co., Detroit, Mich.
Standard Engineering Wks., Pawtucket, R. I.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

HYGROSTATS

See Humidistats

IMMERSION THERMOSTATS

See Thermostats, Immersion

INDICATING THERMOMETERS

See Thermometers, Indicating

INDICATOR-CONTROLLERS, RELATIVE HUMIDITY

●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadeplhia, Pa.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

INDICATOR-CONTROLLERS, TEMPERATURE

●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

INDICATORS, SOUND LEVEL

General Electric Co., Schenectady, N. Y.
Industrial Apparatus Co., Chicago, Ill.
Johns-Manville, New York, N. Y.

INDIRECT HEATING SURFACE

See Surface, Heating

INDIRECT WATER HEATERS

See Heaters, Water, Indirect

INDUSTRIAL AIR CONDITIONERS

See Unit Air Conditioners, Industrial

INSTANTANEOUS WATER HEATERS

See Heaters, Water, Steam, Instantaneous

INSULATION, BUILDING

Acme Asbestos Covering & Flooring Co., Chicago, Ill. (Rock wool)
Alfol Insulation Co., New York, N. Y. (Aluminum foil)
Alton Mineral Wool Co., Alton, Ill.
American Flange & Mfg. Co., Inc., New York, N. Y. (Metal sheets)
●American Hair & Felt Co., Chicago, Ill. (Hair felt)
●Armstrong Cork Products Co., Lancaster, Pa. (Corkboard, fibreboard)
Bache & Co., Semon, New York, N. Y. (Glass wool)
Barber Co., Philadelphia, Pa.
Berry, Jr. & Co., Inc., F. E., Boston, Mass.
Cabot, Inc., Samuel, Boston, Mass. (Flexible)
●Carey Co., Philip, Lockland, Cincinnati, O. (Rock wool).
●Celotex Co., Chicago, Ill.

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Chamberlin Metal Weather Strip Co., Detroit, Mich. (Rock wool)
Certain-teed Products Corp., New York, N. Y. (Board; reflective).
Continental Diamond Fibre Co., Newark, Del.
●Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., Inc., New York, N. Y. (Corkboard).
Cornell Wood Products Co., Chicago, Ill.
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool)
Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Cork, wool, felt)
Fir-Tex Insulating Board Co., St. Helens, Ore. (Wood fibreboard)
General Insulating & Mfg. Co., Alexandria, Ind. (Loose fill-Blanket-Bat)
General Insulating Products Co., Brooklyn, N. Y. (Rock wool)
Hinde & Dauch Paper Co., Sandusky, O.
Insulite Co., Minneapolis, Minn. (Wood fibre)
International Vermiculite Co., Springfield, Ill. (Loose fill)
Johns-Manville, New York, N. Y. (Rock wool and wood fibreboard)
Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
Masonite Corp., Chicago, Ill. (Fibre board)
Mineral Felt Co., Toledo, O.
Mineral Insulation Co., Chicago Ridge, Ill. (Rock wool)
●Mundet Cork Corp., New York, N. Y. (Cork)
National Gypsum Co., Buffalo, N. Y.
Nelson Mfg. Co., B. F., Minneapolis, Minn.
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Rock wool, vermiculite, asbestos)
Pacific Lumber Co., San Francisco, Cal.
Refractory & Insulation Corp., New York, N. Y. (Rock, slag wool)
Reynolds Corp., New York, N. Y. (Aluminum foil)
Rock Products Co., Nashville, Tenn. (Rock wool)
Rock Wool Products Co., Wabash, Ind. (Loose fill)
Ruberoid Co., New York, N. Y. (Mineral wool)
Russell Insulation Co., F. C., Baltimore, Md.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Specialty Converters, Inc., Chicago, Ill.
Sprayo-Flake Co., Chicago, Ill.
Standard Asbestos Mfg. Co., Chicago, Ill. (Asbestos, hairfelt)
Standard Lime & Stone Co., Baltimore, Md. (Rock wool)
Thermax Div., Northwest Magnesite Co., Pittsburgh, Pa. (Rigid)
Therminsul Corp., Kalamazoo, Mich.
Truscon Steel Co., Youngstown, O. (Insulation board sealed between metal sheets)
Union Fibre Co., Inc., Winona, Minn. (Rock wool)
United Cork Companies, Lyndhurst, N. J. (Cork)
United States Gypsum Co., Chicago, Ill. (Wool and board)
United States Mineral Wool Co., Chicago, Ill. (Mineral wool)
Universal Gypsum & Lime Co., Chicago, Ill. (Loose fill)
Upson Co., Lockport, N. Y.
Wilson & Co., Chicago, Ill. (Board)
Wood Conversion Co., St. Paul, Minn. (Nu-Wood board, balsam-wool blanket)

INSULATION, DUCT

Acme Asbestos Covering & Flooring Co., Chicago, Ill. (Asbestos)
Alfol Insulation Co., New York, N. Y. (Aluminum foil)
American Flange & Mfg. Co., Inc., New York, N. Y. (Metal sheets)
●American Hair & Felt Co., Chicago, Ill. (Hair felt)
●Armstrong Cork Products Co., Lancaster, Pa. (Corkboard, fibreboard)
Berry, Jr. & Co., Inc., F. E., Boston, Mass.
Burgess Battery Co., Chicago, Ill. (Balsam, wool)
Cabot, Inc., Samuel, Boston, Mass. (Flexible)
●Carey Co., Philip, Lockland, Cincinnati, O. (Asbestos)
●Celotex Co., Chicago, Ill.
●Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., Inc., New York, N. Y. (Cork board)
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool blankets)
Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Cork, magnesia, hair felt)
Fir-Tex Insulating Board Co., St. Helens, Ore. (Wood fibreboard)
General Insulating & Mfg. Co., Alexandria, Ind. (Block)
General Insulating Products Co., Brooklyn, N. Y. (Acoustic rock wool)
Insulite Co., Minneapolis, Minn. (Wood fibre)
International Vermiculite Co., Springfield, Ill. (Block)
Johns-Manville, New York, N. Y. (Rock cork, asbestos)
Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
Masonite Corp., Chicago, Ill. (Fibre board)
Mineral Felt Co., Toledo, O.
Mineral Insulation Co., Chicago Ridge, Ill. (Rock wool)
●Mundet Cork Corp., New York, N. Y. (Cork)
Nelson Mfg. Co., B. F., Minneapolis, Minn.
●Owens-Illinois Glass Co., Toledo, O. (Glass wool)
Presstite Engineering Co., St. Louis, Mo. (Adhesive)
Ruberoid Co., New York, N. Y. (Asbestos cellular and laminated sheets or blocks)
Russell Insulation Co., F. C., Baltimore, Md.
Sall Mountain Co., Chicago, Ill. (Asbestos)
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Self-Vulcanizing Rubber Co., Inc., Chicago, Ill.
Smith & Kanzler, Inc., Elizabeth, N. J. (Asbestos air cell type)
Standard Asbestos Mfg. Co., Chicago, Ill. (Asbestos, hair felt)
Thermax Div., Northwest Magnesite Co., Pittsburgh, Pa. (Rigid)
Therminsul Corp., Kalamazoo, Mich.
United Cork Companies, Lyndhurst, N. J. (Cork)
Western Felt Wks., Chicago, Ill. (Felt)
Wilson & Co., Chicago, Ill. (Flexible)
●Wilson, Inc., Grant, Chicago, Ill.
Wood Conversion Co., St. Paul, Minn. (Balsam-wool)

INSULATION, SOUND DEADENING, CEILING AND WALL

●American Hair & Felt Co., Chicago, Ill.
●Armstrong Cork Products Co., Lancaster, Pa.
Barber Co., Philadelphia, Pa.
Berry, Jr. & Co., Inc., F. E., Boston, Mass.
Burgess Battery Co., Chicago, Ill.
Cabot, Inc., Samuel, Boston, Mass. (Flexible)
Celotex Co., Chicago, Ill.
Chamberlin Metal Weatherstrip Co., Detroit, Mich. (Rock wool)
Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Rock wool, hair felt)
Felters Co., Inc., Boston, Mass.
Fir-Tex Insulating Board Co., St. Helens, Ore.
General Insulating & Mfg. Co., Alexandria, Ind.
General Insulating Products Co., Brooklyn, N. Y. (Insulwool-tile & blanket)
Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa. (Sprayed)
Masonite Corp., Chicago, Ill. (Fibreboard)
Mineral Felt Co., Toledo, O.
Rock Products Co., Nashville, Tenn.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Thermax Div., Northwest Magnesite Co., Pittsburgh, Pa. (Rigid)
Therminsul Corp., Kalamazoo, Mich.
Wood Conversion Co., St. Paul, Minn. (Nu-Wood, Balsam-wool)

INSULATION, SOUND DEADENING, DUCT

●American Hair & Felt Co., Chicago, Ill.
●Armstrong Cork Products Co., Lancaster, Pa.
Berry, Jr. & Co., Inc., F. E., Boston, Mass.
Burgess Battery Co., Chicago, Ill.
Cabot, Inc., Samuel, Boston, Mass. (Flexible)
●Celotex Co., Chicago, Ill.
Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Rock wool, hair felt)
Felters Co., Inc., Boston, Mass.
Fir-Tex Insulating Board Co., St. Helens, Ore.
General Insulating & Mfg. Co., Alexandria, Ind.
General Insulating Products Co., Brooklyn, N. Y. (Insulwool blanket)
Inter-Coastal Paint Corp., East St. Louis, Ill.
Johns-Manville, New York, N. Y.
Masonite Corp., Chicago, Ill.
Maxim Silencer Co., Hartford, Conn.
Mineral Felt Co., Toledo, O.
Mortell Co., J. W., Chicago, Ill.
Nelson Mfg. Co., B. F., Minneapolis, Minn.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Thermax Div., Northwest Magnesite Co., Pittsburgh, Pa. (Rigid)
Therminsul Corp., Kalamazoo, Mich.
Wilson & Co., Chicago, Ill.
Wood Conversion Co., St. Louis, Minn. (Balsam-wool)

IONIZATION APPARATUS

American Hydrozone Co., Inc., New York, N. Y.
Corozone Air Conditioning Corp., Cleveland, O.
Electroaire Corp., Chicago, Ill.
Fresh'nd-Aire Co., Chicago, Ill.
Montgomery Bros., San Francisco, Cal.
United States Ozone Co. of America, Scottdale, Pa.

IRON BODY VALVES

See Valves, Gate and Valves, Globe

JOINTS, FLANGED

Blaw-Knox Co., Blawnox, Pa.
●Crane Co., Chicago, Ill.
Floersheim & Co., B., Pittsburgh, Pa.
●Grinnell Co., Inc., Providence, R. I.
Kellogg Co., M. W., The, New York, N. Y.
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden Van Stone Co., South Boston, Mass.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Valve & Mfg. Co., Pittsburgh, Pa.
Parks-Cramer Co., Fitchburg, Mass.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Power Piping Co., Pittsburgh, Pa.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Semet-Solvay Engineering Corp., New York, N. Y.
Shaw Co., Benjamin F., Wilmington, Del.
Taylor Forge & Pipe Wks., Chicago, Ill.
●Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 232.

JOINTS, PIPE, EXPANSION

●American District Steam Co., North Tonawanda, N. Y.
Badger & Sons Co., E. B., Boston, Mass. (Corrugated copper, stainless steel)
Badger Fire Extinguisher Co., Boston, Mass.
Barco Mfg. Co., Chicago, Ill.
Belfield Co., H., Philadelphia, Pa.
Bordo Co., Inc., L. J. Glenside, Pa.
Central Station Steam Co., Detroit, Mich.
Chase Brass & Copper Co., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Direct Separator Co., Inc., Syracuse, N. Y.
Dresser Mfg. Co., S. R., Bradford, Pa.
Floersheim & Co., B., Pittsburgh, Pa.
Foster Wheeler Corp., New York, N. Y.
Harris & Co., Arthur, Chicago, Ill.
Howard Iron Wks. & Alberger Heater Co., Buffalo, N .Y.
●Illinois Engineering Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kopperman & Sons, Joseph B., Philadelphia, Pa.
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden Van Stone Co., South Boston, Mass.
National Valve & Mfg. Co., Pittsburgh, Pa.
Northern Indiana Brass Co., Elkhart, Ind.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Seamlex Co., Long Island City, N. Y. (Flexible, seamless)
Semet-Solvay Engineering Corp., New York, N. Y.
United States Rubber Products, Inc., New York, N. Y. (Rubber)
Victaulic Co. of America, New York, N. Y.
●Walworth Co. New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
●Yarnall-Waring Co., Philadelphia, Pa.

LACQUERS

See Enamels and Lacquers

LEAD PIPE

See Pipe, Lead

LEAD SHEETS

See Sheets, Lead

LEAK DETECTORS

See Detectors, Leak, Refrigerant

LEATHER BELTING

See Belting, Leather

LEATHER PACKING

See Packing, Leather

LIQUID LEVEL GAGES

See Gages, Liquid Level

LIQUID LEVEL RECORDERS

See Recorders, Liquid Level

LIQUID PRESSURE REGULATORS

See Regulators, Pressure, Liquid

LOCK FORMING MACHINES

See Machines, Pittsburgh Lock Forming

LOUVERS AND SHUTTERS

●Air Conditioning Products Co., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American Warming & Ventilating Co., Toledo, O.
Arex Co., Chicago, Ill.
●Autovent Fan & Blower Co., Chicago, Ill.
Champion Blower & Forge Co., Lancaster, Pa.
Chicago Metal Mfg. Co., Chicago, Ill.
Cornell Iron Wks., Inc., Long Island City, N. Y. (Rolling steel)
Economy Electric Mfg. Co., Chicago, Ill.
Elgo Shutter & Mfg. Co., Detroit, Mich.
Gillian Mfg. .Co., Ferndale, Mich.
●Kelvin-White Co., Boston, Mass.
Kirk & Blum Mfg. Co., Cincinnati, O.
Kleenaire Corp., Stevens Point, Wis.
Mountain States Equipment Co., Denver, Colo.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Robertson Co., H. H., Pittsburgh, Pa.
Strandwitz & Co., Inc., Camden, N. J.
Utility Fan & Mfg. Co., Los Angeles, Cal.
Viking Air Conditioning Corp., Cleveland, O.
●Waterloo Register Co., Waterloo, Ia.

LUBRICATING OIL

See Oil, Lubricating

MACHINES AND FILM, X-RAY

Eastman Kodak Co., Rochester, N. Y.
Kelly-Koet, Covington, Ky.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MACHINES, PIPE CUTTING AND THREADING, PORTABLE

Air Reduction 'Sales Co., New York, N. Y. (Cutting and beveling)
●Beaver Pipe Tools, Inc., Warren, O.
Curtis & Curtis Co., Bridgeport, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
●Linde Air Products Co., The, New York, N. Y. (Cutting and bevelling)
Nye Tool & Machine Wks., Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Peerless Mach. Co., Racine, Wis.
●Ridge Tool Co., Elyria, O. (Hand)
Toledo Pipe Threading Machine Co., Toledo, O.

MACHINES, PIPE CUTTING AND THREADING, STATIONARY

●Beaver Pipe Tools, Inc., Warren, O.
Bignall & Keeler Machine Wks., Edwardsville, Ill.
Bullard Co., Bridgeport, Conn. (Vertical, threading & boring)
Curtis & Curtis Co., Bridgeport, Conn.
Jarecki Mfg. Co., Erie, Pa.
Landis Machine Co., Inc., Waynesboro, Pa.
Merrell Mfg. Co., Toledo, O.
Oster Mfg. Co., Cleveland, O.
Saunders Sons, Inc., D., Yonkers, N. Y.
Toledo Pipe Threading Machine Co., Toledo, O.

MACHINES, PITTSBURGH LOCK FORMING

Ward Machinery Co., Chicago, Ill.

MACHINES, REFRIGERATION, ABSORPTION

●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.

MALLEABLE UNIONS

See Unions, Malleable

MANOMETERS

●American Blower Corp., Detroit, Mich.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
Defender Automatic Regulator Co., St. Louis, Mo.
Friez & Sons, Inc., Julien P., Baltimore, Md.
●Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Morey & Jones, Ltd., Los Angeles, Cal.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

MECHANICAL DRIVE TURBINES

See Turbines, Mechanical Drive

MECHANICAL TRAPS

See Traps, Steam, Mechanical

METAL HOSE

See Hose, Metal, for Eliminating Compressor Vibration

METALLIC BELLOWS

See Bellows, Metallic

METALLIC PACKING

See Packing, Metallic

METERS, AIR VELOCITY, DIRECT READING

●Detroit Air Meter Co., Detroit, Mich.
Friez & Sons, Inc., Julien P., Baltimore, Md.
●Illinois Testing Laboratories, Inc., Chicago, Ill.

METERS, CONDENSATION

●American District Steam Co., North Tonawanda, N. Y.
Buffalo Meter Co., Buffalo, N. Y.
Central Station Steam Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Worthington-Gamon Meter Co., Harrison, N. J.

METERS, FLOW, PROCESS LIQUID

Bailey Meter Co., Cleveland, O.
●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadephia, Pa.
Buffalo Meter Co., Buffalo, N. Y.
Foxboro Co. Foxboro, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
Morey & Jones, Ltd., Los Angeles, Cal.
Republic Flow Meters Co., Chicago, Ill.
Spray Engineering Co., Somerville, Mass.
Tagliabue Mfg. Co., C. J:, Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.

METERS, FLOW, STEAM

●American District Steam Co., North Tonawanda, N. Y.
American Meter Co., New York, N. Y.
Bailey Meter Co., Cleveland, O.
●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
Cochrane Corp., Philadelphia, Pa.

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Foxboro Co., Foxboro, Mass.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Morey & Jones, Ltd., Los Angeles, Cal.
Republic Flow Meters Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.

METERS, WATER

Bailey Meter Co., Cleveland, O.
Buffalo Meter Co., Buffalo, N. Y.
Builders Iron Foundry, Providence, R. I.
Foxboro Co., Foxboro, Mass.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
National Meter Co., Brooklyn, N. Y.
Neptune Meter Co., New York, N. Y.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Republic Flow Meters Co., Chicago, Ill.
Union Water Meter Co., Worcester, Mass.
Worthington-Gamon Meter Co., Harrison, N. J.

MIXING VALVES

See Valves, Mixing, Steam and Water

MODULATING VALVES

See Valves, Radiator, Steam and Hot Water

MOTOR BASES

See Bases and Pads, Vibration Isolating

MOTOR CONTROLLERS

See Controllers and Starters, Motor

MOTOR-OPERATED VALVES

See Valves, Motor-operated

MOTOR STARTERS

See Controllers and Starters, Motor

MOTORS, ELECTRIC, FRACTIONAL HP

●Baldor Electric Co., St. Louis, Mo.
●Barber-Colman Co., Rockford, Ill.
Black & Decker Mfg. Co., Towson, Md.
Bodine Electric Co., Chicago, Ill.
Brown-Brockmeyer Co., Dayton, O.
Burke Electric Co., Erie, Pa.
●Century Electric Co., St. Louis, Mo.
●Delco Products Corp., Dayton, O.
Diehl Mfg. Co., Elizabeth, N. J.
Emerson Electric Mfg. Co., St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.
●General Electric Co., Schenectady, N. Y.
●Holtzer-Cabot Electric Co., Boston, Mass.
Howell Electric Motors Co., Howell, Mich.
Janette Mfg. Co., Chicago, Ill.
Leland Electric Co., Dayton, O.
Marathon Electric Mfg. Corp., Wausau, Wis.
Master Electric Co., Dayton, O.
Ohio Electric Mfg. Co., Cleveland, O.
Peerless Electric Co., Warren, O.
Robbins & Myers, Inc., Springfield, O.
Speedway Mfg. Co., Chicago (Cicero), Ill.
Star Electric Motor Co., Bloomfield, N. J.
Sterling Electric Motors, Inc., Los Angeles, Cal.
●Sturtevant Co., B. F., Boston, Mass.
U. S. Electrical Motors, Inc., Los Angeles, Cal.
●Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS, ELECTRIC, 1 HP AND OVER

Allis Co., Louis, Milwaukee, Wis.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●Baldor Electric Co., St. Louis, Mo.
Brown-Brockmeyer Co., Dayton, O.
Burke Electric Co., Erie, Pa.
●Century Electric Co., St. Louis, Mo.
Continental Electric Co., Inc., Newark, N. J.
Crocker-Wheeler Elec. Mfg. Co., Ampere, N. J.
●Delco Products Corp., Dayton, O.
Diehl Mfg. Co., Elizabeth, N. J.
Electric Machinery Mfg. Co., Minneapolis, Minn.
Elliott Co., Jeanette, Pa.
Emerson Electric Mfg. Co., St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.
●General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee, Wis.
●Holtzer-Cabot Electric Co., Boston, Mass. (2 & less)
Howell Electric Motors Co., Howell, Mich.
Ideal Electric & Mfg. Co., Mansfield, O.
Imperial Electric Co., Akron, O.
Janette Mfg. Co., Chicago, Ill.
Leland Electric Co., Dayton, O.
Lincoln Electric Co., Cleveland, O.
Marble-Card Electric Co., Gladstone, Mich.
Master Electric Co., Dayton, O.
Peerless Electric Co., Warren, O.
Philadelphia Gear Co., Philadelphia, Pa. (Geared)
Reliance Electric & Engineering Co., Cleveland, O.
Robbins & Myers, Inc., Springfield, O.
Star Electric Motor Co., Bloomfield, N. J.
Sterling Electric Motors, Inc., Los Angeles, Cal.
●Sturtevant Co., B. F., Boston, Mass.
Triumph Ice Machine Co., Cincinnati, O.
U. S. Electrical Motors, Inc., Los Angeles, Cal.
●Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Zobell Electric Motor Corp., Garwood, N. J.

MUSHROOM VENTILATORS

See Ventilators, Mushroom

NEEDLE VALVES

See Valves, Needle

NIPPLES, PIPE, BRASS AND COPPER

Acheson Mfg. Co., Rankin, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Nipple Mfg. Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
●Grinnell Co., Inc., Providence, R. I.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Mfg. Co., New York, N. Y.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa
Phoenix Brass Fittings Corp., Irvington, N. J.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Shaw-Kendall Engineering Co., Toledo, O.
●Walworth Co., New York, N. Y.
Weatherhead Co., Cleveland, O.

NIPPLES, PIPE, IRON AND STEEL

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
Byers Co., A. M., Pittsburgh, Pa. (Wrought iron)
Chicago Nipple Mfg. Co., Chicago, Ill.
Cohoes Rolling Mill Co., Cohoes, N. Y.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Dresser Mfg. Co., S. R., Bradford, Pa.
●Grinnell Co., Inc., Providence, R. I.
Jarecki Mfg. Co., Erie, Pa.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Reading Iron Co., Philadelphia, Pa.
Shaw-Kendall Engineering Co., Toledo, O.
●Walworth Co., New York, N. Y.

NOISE ELIMINATORS

See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration; Insulation, Sound Deadening

NOZZLES, SPRAY

Balloffet Diamond Wire Dies Co., Guttenberg, N. J.
Bayley Blower Co., Milwaukee, Wis.
●Binks Mfg. Co., Chicago, Ill.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Chain Belt Co., Milwaukee, Wis.
Cooling Tower Co., Inc., New York, N. Y.
●Detroit Lubricator Co., Detroit, Mich.
Dustlix Systems, Inc., Milwaukee, Wis.
Goodrich Co., B. F., Akron, O.
Howell Mfg. Co., Kansas City, Mo.
International Moistening Co., Providence, R. I.
●Marley Co., Kansas City, Mo.
Martocello & Co., Jos. A., Philadelphia, Pa.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
Northern Indiana Brass Co., Elkhart, Ind.
Parks-Cramer Co., Fitchburg, Mass.
Penn Cooling Tower Wks., Pittsburgh, Pa.
Rega Mfg. Co., Rochester, N. Y.
Ross Sprinkler Co., Pasadena, Cal.
Schubert-Christy Corp., Affton, Mo.
Schutte & Koerting Co., Philadelphia, Pa.
Skinner Irrigation Co., Troy, O.
Spray Engineering Co., Somerville, Mass.
Strandwitz & Co., Inc., Camden, N. J.
●Sturtevant Co., B. F., Boston, Mass.
●Westinghouse Electric & Mfg. Co., Mansfield, O.
●Yarnall-Waring Co., Philadelphia, Pa.
●York Ice Machinery Corp., York, Pa

ODOR ADSORBERS

See Filters, Air

OIL BURNERS

See Burners, Oil

OIL, LUBRICATING

●Frick Co., Waynesboro, Pa.
Houghton & Co., E. F., Philadelphia, Pa.
Indian Refining Co., Indianapolis, Ind.
Marathon Oil Co., Tulsa, Okla.
Mid-Continent Petroleum Corp., Tulsa, Okla.
Sinclair Refining Co., New York, N. Y.
Standard Oil Co. of California, San Francisco, Cal.
Standard Oil Co. of Indiana, Chicago, Ill.
Texas Co., New York, N. Y.
●York Ice Machinery Corp., York, Pa.

OIL SEPARATORS

See Separators, Steam and Oil

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OPERATORS, DAMPER, DUCT

●Automatic Products Co., Milwaukee, Wis.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
Cooper Co., Clark, Philadelphia, Pa.
●Detroit Lubricator Co., Detroit, Mich.
●General Controls Co., San Francisco, Cal.
●Johnson Service Co., Milwaukee, Wis.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
Taylor Instrument Companies, Rochester, N. Y.

OPERATORS, VALVE

Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
Cooper Co., Clark, Philadelphia, Pa.
●Detroit Lubricator Co., Detroit, Mich.
●General Controls Co., San Francisco, Cal.
General Electric Co., Schenectady, N. Y.
●Johnson Service Co., Milwaukee, Wis.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Perfex Corp (Controls Div), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
Taylor Instrument Companies, Rochester, N. Y.

OXY-ACETYLENE WELDING

See Welding and Cutting Apparatus, Oxy-Acetylene

OZONE APPARATUS

American Hydrozone Co., Inc., New York, N. Y.
Corozone Air Conditioning Corp., Cleveland, O.
Electroaire Corp., Chicago, Ill.
Fresh'nd-Aire Co., Chicago, Ill.
Montgomery Bros., San Francisco, Cal.
Norwood Engineering Co., Florence, Mass.
Polar Air, Inc., Dallas, Texas.
Sealkote Corp., Chicago, Ill.
Triox Engineering Co., St. Louis, Mo.
United States Ozone Co. of America, Scottdale, Pa.

PACKING, ASBESTOS

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Allpax Co., Inc., Mamaroneck, N. Y.
Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., Philadelphia, Pa.
●Carey Co., Philip, Lockland, Cincinnati, O.
Chicago Specialty Mfg. Co., Chicago, Ill.
Crandall Packing Co., Palmyra, N. Y.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y.
Durabla Mfg. Co., New York, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Garlock Packing Co., Palmyra, N. Y.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Goodrich Co., B. F., Akron, O.
Greene, Tweed & Co., New York, N. Y.
Jenkins Bros., New York, N. Y.
Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Klingerit, Inc., New York, N. Y. (Sheet & rod)
Metallo Gasket Co., New Brunswick, N. J.
Sall Mountain Co., Chicago, Ill.
United States Rubber Products, Inc., New York, N. Y.
Williams Gauge Co., Pittsburgh, Pa.
Wilson, Inc., Grant, Chicago, Ill.

PACKING, FIBRE

Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., Philadelphia, Pa.
Crandall Packing Co., Palmyra, N. Y.
Darcoid Co., Inc., New York, N. Y.
Durabla Mfg. Co., New York, N. Y.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Endura Mfg. Corp., Quakertown, Pa.
Garlock Packing Co., Palmyra, N. Y.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Johns-Manville, New York, N. Y.
Metallo Gasket Co., New Brunswick, N. J.
Union Fibre Co., Inc., Winona, Minn.

PACKING, LEATHER

Belmont Packing & Rubber Co., Philadelphia, Pa.
Chicago Belting Co., Chicago, Ill.
Crandall Packing Co., Palmyra, N. Y.
Excelsior Leather Washer Co., Rockford, Ill.
Graton & Knight Co., Worcester, Mass.
Rhoads & Sons, J. E., Wilmington, Del.
●Watson-Stillman Co., Roselle, N. J.

PACKING, METALLIC

Aeco Packing Products Co., Chicago, Ill.
Allpax Co., Inc., Mamaroneck, N. Y.
Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., Philadelphia, Pa.
Conneaut Packing Co., Conneaut, O.
Crandall Packing Co., Palmyra, N. Y.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y.
Felt Products Mfg. Co., Chicago, Ill.
France Packing Co., Tacony, Philadelphia, Pa.
Garlock Packing Co., Palmyra, N. Y.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Hound Packing Co., Chicago, Ill.
Johns-Manville, New York, N. Y.
Klingerit, Inc., New York, N. Y. (Sheet & rod)
Rotary Seal Co., Chicago, Ill.
United States Rubber Products, Inc., New York, N. Y.
Williams Gauge Co., Pittsburgh, Pa.

PACKING, RUBBER

Akron Metallic Gasket Co., Akron, O.
Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., Philadelphia, Pa.
Boston Woven Hose & Rubber Co., Cambridge, Mass.
Chicago Specialty Mfg. Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Crandall Packing Co., Palmyra, N. Y.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Garlock Packing Co., Palmyra, N. Y.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Hamilton Rubber Mfg. Co., Trenton, N. J.
Houghton & Co., E. F., Philadelphia, Pa.
Jenkins Bros., New York, N. Y.
Johns-Manville, New York, N. Y.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Republic Rubber Co., Youngstown, O.
United States Rubber Products, Inc., New York, N. Y.

PANELS, ACCESS

Higgin Products, Inc., Newport, Ky.
Kane Mfg. Co., Kane, Pa.
Lawson Co., F. H., Cincinnati, O.

PARTS, PRESSED AND STAMPED SHEET METAL

Berger Mfg. Co., Div. of Republic Steel Corp., Canton, O.
Bossert Corp., Utica, N. Y.
Dayton Rogers Mfg. Co., Minneapolis, Minn.
Geuder, Paeschke & Frey Co., Milwaukee, Wis.
Gillian Mfg. Co., Ferndale, Mich.
Martin-Parry Corp., York, Pa.
Maysteel Products, Inc., Mayville, Wis.
Mullins Mfg. Corp., Salem, O.
Scovill Mfg. Co., Waterbury, Conn.
Utica Products, Inc., Utica, N. Y.
Youngstown Pressed Steel Co., Warren, O.

PILLOW BLOCKS

See Blocks, Pillow

PIPE, ALLOY

Allegheny Steel Co., Brackenridge, Pa.
Aluminum Co. of America, Pittsburgh, Pa.
●American Brass Co., Waterbury, Conn.
Antaciron, Inc., Raritan, N. J.
Babcock & Wilcox Co., New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Colonial Stove Co., Specialties Div., Philadelphia, Pa.
Duraloy Co., Pittsburgh, Pa.
Duriron Co., Inc., Dayton, O.
International Nickel Co., New York, N. Y. (Monel)
●National Tube Co., Pittsburgh, Pa.
●Republic Steel Corp., Cleveland, O.
Revere Copper & Brass, Inc., New York, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Spang-Chalfant, Inc., Pittsburgh, Pa.
●Wheeling Steel Corp., Wheeling, W. Va.

PIPE, ASBESTOS FIBRE AND CEMENT

Allen-Sherman-Hoff Co., Philadelphia, Pa.
●Carey Co., Philip, Lockland, Cincinnati, O.
Continental Diamond Fibre Co., Newark, Del. (Fibre, bakelite)
Johns-Manville, New York, N. Y.
●Ric-Wil Co., Cleveland, O.
Sall Mountain Co., Chicago, Ill.
●Wilson, Inc., Grant, Chicago, Ill.

PIPE BENDERS

See Benders, Conduit and Pipe

PIPE, BRASS AND COPPER

●American Brass Co., Waterbury, Conn.
American Radiator Co., New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.

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Chase Brass & Copper Co., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Phelps Dodge Copper Products Corp., British American Tube Div., New York, N. Y.
Revere Copper & Brass Inc., New York, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
●Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
United States Brass & Copper Co., Hyde Park, Boston, Mass.
Wolverine Tube Co., Detroit, Mich.

PIPE, CAST IRON, PRESSURE, BELL AND SPIGOT

Alabama Pipe Co., Anniston, Ala.
American Cast Iron Pipe Co., Birmingham, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
●Crane Co., Chicago, Ill.
Lynchburg Foundry Co., Lynchburg, Va.
McWane Cast Iron Pipe Co., Birmingham, Ala.
U. S. Pipe & Fdry. Co., Burlington, N. J.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE, CAST IRON, PRESSURE, FLANGED

Alabama Pipe Co., Anniston, Ala.
American Cast Iron Pipe Co., Birmingham, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
●Crane Co., Chicago, Ill.
McWane Cast Iron Pipe Co., Birmingham, Ala.
U. S. Pipe & Fdry. Co., Burlington, N. J.
●Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE, CAST IRON, THREADED

American Cast Iron Pipe Co., Birmingham, Ala.
American Radiator Co., New York, N. Y.
Clow, Jas. B. & Sons, Chicago, Ill.
●Crane Co., Chicago, Ill.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill. (Steam-jacketed)
McWane Cast Iron Pipe Co., Birmingham, Ala.
Somerville Iron Wks., Somerville, N. J.
U. S. Pipe & Foundry Co., Burlington, N. J.
●Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE COUPLINGS

See Couplings, Pipe

PIPE COVERING

See Covering, Pipe

PIPE CUTTERS

See Cutters, Pipe and Tubing

PIPE CUTTING MACHINES

See Machines, Pipe Cutting and Threading

PIPE FITTINGS

See Fittings, Pipe

PIPE FLANGES

See Flanges, Pipe

PIPE, GLASS

Corning Glass Wks., Corning, N. Y.

PIPE HANGERS

See Hangers and Supports, Pipe

PIPE JOINT COMPOUNDS

See Cement and Compounds, Pipe Joint

PIPE, LEAD

Andrews Lead Co., Long Island City, N. Y.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.

PIPE, LINED

American Cast Iron Pipe Co., Birmingham, Ala. (Cement)
American Hard Rubber Co., New York, N. Y. (Rubber)
Cohoes Rolling Mill Co., Cohoes, N. Y. (Cement)
Goodrich Co., B. F., Akron, O. (Rubber-lined)
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead and tin lined)
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan, Inc., Passaic, N. J. (Rubber)
National Lead Co., New York, N. Y. (Lead)
●National Tube Co., Pittsburgh, Pa. (Cement)
Pfaudler Co., Rochester, N. Y. (Glass lined)
Public Works Supply Co., Lynn, Mass. (Cement)
●Republic Steel Corp., Cleveland, O. (Cement lined)
Resisto Pipe & Valve Co., East Cambridge, Mass. (Lead)
United States Rubber Products, Inc., New York, N. Y. (Rubber)
Vitreous Enameling & Stamping Co., New York, N. Y. (Enamel)
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE LINE STRAINERS

See Strainers, Pipe Line

PIPE NIPPLES

See Nipples, Pipe, Wrought

PIPE REAMERS

See Reamers, Pipe

PIPE REPAIR CLAMPS

See Clamps, Pipe Repair

PIPE, SEAMLESS, STEEL

Babcock & Wilcox Co., New York, N. Y.
Globe Steel Tubes Co., Milwaukee, Wis.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
●National Tube Co., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Spang-Chalfant, Inc., Pittsburgh, Pa.
Timken Steel & Tube Co., Canton, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

PIPE, SPIRAL, RIVETED AND WELDED

Abendroth & Root Mfg. Co., Newburgh, N. Y.
●American Rolling Mill Co., Middletown, O.
Naylor Pipe Co., Chicago, Ill.
Taylor Forge & Pipe Wks., Chicago, Ill.

PIPE, STEEL

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
●American Rolling Mill Co., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Byers Co., A. M., Pittsburgh, Pa.
Central Tube Co., Pittsburgh, Pa.
Cohoes Rolling Mill Co., Cohoes, N. Y.
Fretz-Moon Tube Co., Butler, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
Mark & Co., Clayton, Chicago, Ill.
●National Tube Co., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Pittsburgh Tube Co., Pittsburgh, Pa.
●Republic Steel Corp., Cleveland, O.
South Chester Tube Co., Chester, Pa.
Spang-Chalfant, Inc., Pittsburgh, Pa.
Wheatland Tube Co., Philadelphia, Pa.
●Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE SUPPORTS

See Hangers and Supports, Pipe

PIPE TONGS

See Tongs, Pipe

PIPE VISES

See Vises, Pipe

PIPE, WOOD

●American District Steam Co., No. Tonawanda, N. Y.
Caldwell Co., W. E., Louisville, Ky.
Michigan Pipe Co., Bay City, Mich.
Wyckoff & Son Co., A., Elmira, N. Y.

PIPE WRENCHES

See Wrenches

PIPE, WROUGHT IRON

Byers Co., A. M., Pittsburgh, Pa.
Cohoes Rolling Mill Co., Cohoes, N. Y.
Reading Iron Co., Philadelphia, Pa.
South Chester Tube Co., Chester, Pa.

PIPE AND FITTINGS, HARD RUBBER

American Hard Rubber Co., New York, N. Y.
Goodrich Co., B. F., Akron, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Stokes Rubber Co., Jos., Trenton, N. J.
United States Rubber Products, Inc., New York, N. Y.

PIPE AND FITTINGS, STONEWARE

General Ceramics Co., New York, N. Y.
Knight, Maurice A., Akron, O. (Stoneware)
U. S. Stoneware Co., New York, N. Y. (Stoneware)

PIPING, FABRICATED

See Bends, Headers, Joints, etc.

PITOT TUBES

See Tubes, Pitot

PLATES, FLOOR AND CEILING

American Radiator Co., New York, N. Y.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Beaton & Corbin Mfg. Co., Southington, Conn.
Chicago Nipple Mfg. Co., Chicago, Ill.
Farley Sleeve & Hanger Co., Cleveland, O.
Globe Machine & Stamping Co., Cleveland, O.
Keeney Mfg. Co., Newington, Conn.
Little Mfg. Co., M. S., Hartford, Conn.
Pittsburgh Valve & Fittings Corp., Barberton, O.

PLUG COCKS

See Valves, Plug

PLUG VALVES

See Valves, Plug

POWER SHEARS

See Shears, Power

● Advertisement in this issue. See Index to Advertisers, page 232.

PREHEATERS, FUEL OIL

●Bell & Gossett Co., Chicago, Ill.
Davis Engineering Corp., Elizabeth, N. J.
General Fittings Co., Providence, R. I.
Griscom-Russell Co., New York, N. Y.
Johnson Co., S. T., Oakland, Cal.
Johnson Corp., Three Rivers, Mich.
●National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Richmond Engineering Co., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Taco Heaters, Inc., New York, N. Y.
Trent Co., Harold E., Philadelphia, Pa.
●Whitlock Coil Pipe Co., Hartford, Conn.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

PRESSURE BLOWERS

See Blowers, Pressure

PRESSURE CONTROLLERS

See Regulators, Pressure

PRESSURE GAGES

See Gages, Pressure

PRESSURE RECORDERS

See Recorders, Pressure

PRESSURE REDUCING VALVES

See Valves, Pressure Reducing and Regulating

PRESSURE REGULATING VALVES

See Valves, Pressure Reducing and Regulating

PRESSURE REGULATORS

See Regulators, Pressure

PRESSURE SWITCHES

See Switches, Pressure and Vacuum

PROPELLER FANS

See Fans, Propeller

PROTECTORS, PIPE COVERING

Carpenter & Paterson, Inc., East Boston, Mass.
Cheney Co., Winchester, Mass.

PSYCHROMETERS, INDICATING

American Moistening Co., Providence, R. I.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Inc., Julien P., Baltimore, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
●Hill, E. Vernon, Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Parks-Cramer Co., Fitchburg, Mass.
Taylor Instrument Companies, Rochester, N. Y.

PSYCHROMETERS, RECORDING

●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Inc., Julien P., Baltimore, Md.
H-B Instrument Co., Philadelphia, Pa.
●Hill, E. Vernon, Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Moeller Instrument Co., Richmond Hill, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

PSYCHROSTATS

See Humidistats

PUMP BASES

See Bases and Pads, Vibration Isolating.

PUMPS, AIR

Beach-Russ Co., New York, N. Y.
Brunner Mfg. Co., Utica, N. Y.
Chicago Pneumatic Tool Co., New York, N. Y.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Davidson Co., M. T., New York, N. Y.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Fuller Co., Catasauqua, Pa.
Gardner-Denver Co., Quincy, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
●Ingersoll-Rand, New York, N. Y.
Kellogg Compressor & Mfg. Corp., Rochester, N. Y.
Leiman Bros., Inc., Newark, N. J.
Martocello & Co., Jos. A., Philadelphia, Pa.
McGowan Co., John H., Cincinnati, O.
●Nash Engineering Co., South Norwalk, Conn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Roots-Connersville Blower Corp., Connersville, Ind.
Skidmore Corp., St. Joseph, Mich.
Trimount Rotary Power Co., East Dedham, Mass.
Uniflow Mfg. Co., Erie, Pa.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, BOILER FEED

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
Berns Specialty Co., Chicago, Ill.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Cissell Mfg. Co., W. M., Louisville, Ky.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
●Deming Co., Salem, O.
Eclipse Fuel Engineering Co., Rockford, Ill.
Economy Pumps, Inc., Chicago, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Wheeler Corp., New York, N. Y.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
●Ingersoll-Rand, New York, N. Y.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kisco Co., Inc., St. Louis, Mo.
Lecourtenay Co., Newark, N. Y.
Micro-Westco, Inc., Bettendorf, Ia.
Morehead Mfg. Co., Detroit, Mich.
●Nash Engineering Co., South Norwalk, Conn.
Roots-Connersville Blower Corp., Connersville, Ind.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Victor Equipment Co., Kimball-Krogh Pump Div., Los Angeles, Cal.
Weil Pump Co., Chicago, Ill.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CENTRIFUGAL

Aldrich Pump Co., Allentown, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Aurora Pump Co., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
Barrett, Haentjens & Co., Hazelton, Pa.
Beach-Russ Co., New York.
Berns Specialty Co., Chicago, Ill.
Blaisdell Compressor Co., New York, N. Y.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chain Belt Co., Milwaukee, Wis.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
Dean Bros. Co., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
●Deming Co., Salem, O.
Domestic Engine & Pump Co., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
Economy Pumps, Inc., Chicago, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Wheeler Corp., New York, N. Y.
Fulflo Specialties Co., Blanchester, O.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
●Ingersoll-Rand, New York, N. Y.
Jackson Co., Byron, Los Angeles, Cal.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kraissl Co., Inc., Hackensack, N. J.
La Bour Pump Co., Inc., Elkhart, Ind.
Lawrence Pump & Engine Co., Lawrence, Mass.
Lecourtenay Co., Newark, N. J.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
McGowan Co., John H., Cincinnati, O.
Micro-Westco, Inc., Bettendorf, Ia.
Morris Machine Wks., Baldwinsville, N. Y.
Myers & Bro. Co., F. E., Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Palmer Electric Co., Detroit, Mich.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Quimby Pump Co., Inc., Newark, N. J.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Schwitzer-Cummins Co., Indianapolis, Ind.
Swaby Mfg. Co., Chicago, Ill.
Taber Pump Co., Buffalo, N. Y.
●Trane Co., La Crosse, Wis.
United Motors Service Co., Detroit, Mich.
Utility Fan Corp., Los Angeles, Cal.
Victor Equipment Co., Kimball-Krogh Pump Div., Los Angeles, Cal.
Weil Pump Co., Chicago, Ill.
Weinman Pump Mfg. Co., Columbus, O.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

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PUMPS, CONDENSATION RETURN

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●American District Steam, North Tonawanda, N. Y.
●American-Marsh Pumps, Inc., Battle Creek, Mich.
American Radiator Co., New York, N. Y.
Aurora Pump Co., Aurora, Ill.
Berns Specialty Co., Chicago, Ill.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Cissell Mfg. Co., W. M., Louisville, Ky.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
●Deming Co., Salem, O.
Domestic Engine & Pump Co., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Economy Pumps, Inc., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Wheeler Corp., New York, N. Y.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
●Ingersoll-Rand, New York, N. Y.
Jackson Co., Byron, Los Angeles, Cal.
Johnson Corp., Three Rivers, Mich.
Kisco Co., Inc., St. Louis, Mo.
Lecourtenay Co., Newark, N. J.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
McGowan Co., John H., Cincinnati, O.
Micro-Westco, Inc., Bettendorf, Ia.
Myers & Bro. Co., F. E., Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
National Steam Pump Co., Upper Sandusky, O.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Quimby Pump Co., Inc., Newark, N. J.
Roots-Connersville Blower Corp., Connersville, Ind.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Skidmore Corp., St. Louis, Mich.
Sterling Engineering Co., Milwaukee, Wis.
Swaby Mfg. Co., Chicago, Ill.
●Trane Co., La Crosse, Wis.
Weil Pump Co., Chicago, Ill.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, DEEP WELL

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Aurora Pump Co., Aurora, Ill.
Caldwell, Farley M., Fort Wayne, Ind.
Columbus Steam Pump Wks., Columbus, O.
●Crane Co., Chicago, Ill.
Davidson Co., M. T., New York, N. Y.
Decatur Pump Co., Decatur, Ill.
●Deming Co., Salem, O.
Duro Co., Dayton, O.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
●Ingersoll-Rand, New York, N. Y.
●Layne & Bowler, Inc., Memphis, Tenn.
Myers & Bro. Co., F. E., Ashland, O.
Micro-Westco, Inc., Bettendorf, Ia.
●Peerless Pump Div., Food Machinery Corp., Massillon, O.
●Pomona Pump Co., Pomona, Cal.
Red Jacket Pump Co., Davenport, Ia.
Roper Corp., Geo. D., Rockford, Ill.
Rumsey Pump Corp., Seneca Falls, N. Y.
Uniflow Mfg. Co., Erie, Pa.
Victor Equipment Co., Kimball-Krogh Pump Div., Los Angeles, Cal.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, FIRE

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●American-Marsh Pumps, Inc., Battle Creek, Mich.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Dayton-Dowd Co., Quincy, Ill.
Economy Pumps, Inc., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
●Ingersoll-Rand, New York, N. Y.
Lecourtenay Co., Newark, N. J.
Morris Machine Wks., Baldwinsville, N. Y.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Rumsey Pump Corp., Seneca Falls, N. Y.
Viking Pump Co., Cedar Falls, Ia.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, HYDRAULIC

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
Bishop & Babcock Sales Co., Cleveland, O.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Davidson Co., M. T., New York, N. Y.
Goulds Pumps, Inc., Seneca Falls, N. Y.
●Ingersoll-Rand, New York, N. Y.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Roper Corp., Geo. D., Rockford, Ill.
Rumsey Pump Corp., Seneca Falls, N. Y.
Victor Equipment Co., Kimball-Krogh Pump Div., Los Angeles, Cal.
Viking Pump Co., Cedar Falls, Ia.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, RECIPROCATING

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Columbus Steam Pump Wks., Columbus, O.
Davidson Co., M. T., New York, N. Y.
●Deming Co., Salem, O.
Domestic Engine & Pump Co., New York, N. Y.
Fairbanks-Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
●Ingersoll-Rand, New York, N. Y.
McGowan Co., John H., Cincinnati, O.
National Steam Pump Co., Upper Sandusky, O.
Rumsey Pump Corp., Seneca Falls, N. Y.
Uniflow Mfg. Co., Erie, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, ROTARY

American Hard Rubber Co., New York, N. Y. (Hard Rubber)
Anderson Rotary Pump Co., New York, N. Y.
Beach-Russ Co., New York, N. Y.
●Blackmer Pump Co., Grand Rapids, Mich.
Davidson Co., M. T., New York, N. Y.
Decatur Pump Co., Decatur, Ill.
Le Laval Steam Turbine Co., Trenton, N. J.
●Deming Co., Salem, O.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Johnson Co., S. T., Oakland, Cal.
Johnston & Jennings Co., Cleveland, O.
Kinney Mfg. Co., Boston, Mass.
Logan Engineering Co., Chicago, Ill. (Radial diaphragm)
Martocello & Co., Jos. A., Philadelphia, Pa.
McGowan Co., John H., Cincinnati, O.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
●Nash Engineering Co., South Norwalk, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Quimby Pump Co., Inc., Newark, N. J.
Roots-Connersville Blower Corp., Connersville, Ind.
Roper Corp., Geo. D., Rockford, Ill.
Rumsey Pump Corp., Seneca Falls, N. Y.
Taber Pump Co., Buffalo, N. Y.
Trimount Rotary Power Co., East Dedham, Mass.
Tuthill Pump Co., Chicago, Ill.
Viking Pump Co., Cedar Falls, Ia.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yale & Towne Mfg. Co., Stamford, Conn.

PUMPS, STEAM

●American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Columbus Steam Pump Wks., Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Domestic Engine & Pump Co., New York, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
●Ingersoll-Rrand, New York, N. Y.
McGowan Co., John H., Cincinnati, O.
National Steam Pump Co., Upper Sandusky, O.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Weinman Pump Co., Columbus, O.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, SUMP

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
Berns Specialty Co., Chicago, Ill.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pneumatic Tool Co., New York, N. Y.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks., Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.

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Dayton-Dowd Co., Quincy, Ill.
Dean Hill Pump Co., Anderson, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
●Deming Co., Salem, O.
Domestic Engine & Pump Co., New York, N. Y.
Economy Pumps, Inc., Chicago, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Goulds Pumps, Inc., Seneca, Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Imperial Brass Mfg. Co., Chicago, Ill.
●Ingersoll-Rand, New York, N. Y.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
McGowan Co., John H., Cincinnati, O.
Micro-Westco, Inc., Bettendorf, Ia.
Morris Machine Wks., Baldwinsville, N. Y.
●Nash Engineering Co., South Norwalk, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Penberthy Injector Co., Detroit, Mich.
Quimby Pump Co., Inc., Newark, N. J.
Rumsey Pump Corp., Seneca Falls, N. Y.
Swaby Mfg. Co., Chicago, Ill.
Taber Pump Co., Buffalo, N. Y.
Uniflow Mfg. Co., Erie, Pa.
Victor Equipment Co., Kimball-Krogh Pump Div., Los Angeles, Cal.
Weil Pump Co., Chicago, Ill.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, VACUUM

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●American-Marsh Pumps, Inc., Battle Creek, Mich.
Beach-Russ Co., New York, N. Y.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pneumatic Tool Co., New York, N. Y.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Davidson Co., M. T., New York, N. Y.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Domestic Engine & Pump Co., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
Economy Pumps, Inc., Chicago, Ill.
Elliott Co., Jeannette, Pa.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Foster Wheeler Corp., New York, N. Y.
Fuller Co., Catasauqua, Pa.
Gardner-Denver Co., Quincy, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
●Hoffman Specialty Co., Waterbury, Conn.
●Ingersoll-Rand, New York, N. Y.
Johnson Corp., Three Rivers, Mich.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., Hackensack, N. J.
Leiman Bros., Inc., Newark, N. J.
McGowan Co., John H., Cincinnati, O.
●Nash Engineering Co., South Norwalk, Conn.
National Steam Pump Co., Upper Sandusky, O.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Reed Steam Equipment Co., Bridgeport, Conn.
Roots-Connersville Blower Corp., Connersville, Ind.
Schutte & Koerting Co., Philadelphia, Pa.
Skidmore Corp., St. Joseph, Mich.
Sterling Engineering Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, VISCOUS LIQUIDS AND HEAVY MATERIALS

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Austin-Mason Co., New York, N. Y.
Beach-Russ Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chain Belt Co., Milwaukee, Wis.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Economy Pumps, Inc., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
●Ingersoll-Rand, New York, N. Y.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Morris Machine Wks., Baldwinsville, N. Y.
Quimby Pump Co., Inc., Newark, N. J.
Roots-Connersville Blower Corp., Connersville, Ind.
Roper Corp., Geo. D., Rockford, Ill.
Rumsey Pump Corp., Seneca Falls, N. Y.
Taber Pump Co., Buffalo, N. Y.
Victor Equipment Co., Kimball-Krogh Pump Div., Los Angeles, Cal.
Viking Pump Co., Cedar Falls, Ia.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUNCHES, SHEET METAL

Bertsch & Co., Inc., Cambridge City, Ind.
●Buffalo Forge Co., Buffalo, N. Y.
Hendley & Wittemore Co., Beloit, Wis.
Kidder Mfg. Co., Inc., J. F., Burlington, Vt.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Parker-Kalon Corp., New York, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Pels & Co., Inc., Henry, New York, N. Y.
Whitney Mfg. Co., W. A., Rockford, Ill.
●Whitney Metal Tool Co., Rockford, Ill.
Wiedemann Machine Co., Philadelphia, Pa.
Zeh & Hanemann Co., Newark, N. J.

QUADRANTS, DAMPER

●Air Conditioning Products Co., Detroit, Mich.
Hart & Cooley Mfg. Co., Chicago, Ill.
Jacobs Co., B. & J., Cincinnati, O.
Northern Weatherstrip Co., Duluth, Minn.
Ohio Products Co., Cleveland, O.
Parker-Kalon Corp., New York, N. Y.
United States Register Co., Battle Creek, Mich.
Young Regulator Co., Cleveland, O.

RADIATION, CONVECTION TYPE, CAST IRON

American Radiator Co., New York, N. Y.
●Crane Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Smith Co., H. B., Westfield, Mass.
●Unit Heater & Cooler Co., Wausau, Wis.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Weil-McLain Co., Chicago, Ill.

RADIATION, CONVECTION TYPE, NON-FERROUS

American Radiator Co., New York, N. Y.
●Bush Mfg. Co., Hartford, Conn.
Commodore Heaters Corp., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
●Grinnell Co., Inc., Providence, R. I.
Hexcel Radiator Co., Racine, Wis.
Manufacturers Fin Coil Co., Chicago, Ill.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
●Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Super Radiator Corp., Minneapolis, Minn.
●Trane Co., La Crosse, Wis.
Trenton Auto Radiator Wks., Trenton, N. J.
Vulcan Radiator Co., Hartford, Conn.
●Webster & Co., Warren, Camden, N. J.
●Young Radiator Co., Racine, Wis.

RADIATION, DIRECT

American Radiator Co., New York, N. Y.
●Burnham Boiler Corp., Irvington, N. Y.
Clow, Jas. B. & Sons, Chicago, Ill. (Gas fired)
Columbia Radiator Co., McKeesport, Pa.
●Crane Co., Chicago, Ill.
Fowler & Wolfe Radiator Co., Norristown, Pa.
Hart & Crouse Co., Inc., Utica, N. Y.
International Heater Co., Utica, N. Y.
Logansport Radiator Equipment Co., Logansport, Ind.
National Radiator Corp., Johnstown, Pa.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Frank, Terre Haute, Ind.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Shaw-Perkins Mfg. Co., Pittsburgh, Pa.
Slater Mfg. Co., Wakefield, Mass. (Baseboard)
Smith Co., H. B., Westfield, Mass.
Thatcher Co., Newark, N. J.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Weil-McLain Co., Chicago, Ill.

RADIATOR HANGERS

See Hangers or Brackets, Radiator

RADIATOR VALVES

See Valves, Radiator

REAMERS, PIPE

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
●Beaver Pipe Tools, Inc., Warren, O.
Mueller Co., Decatur, Ill.
Nye Tool & Machine Wks., Chicago, Ill.
Toledo Pipe Threading Machine Co., Toledo, O.
●Walworth Co., New York, N. Y.

RECIPROCATING PUMPS

See Pumps, Reciprocating

●Advertisement in this issue. See Index to Advertisers, page 232.

RECORDER-CONTROLLERS, COMBINED TEMPERATURE AND HUMIDITY

●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
●Powers Regulator Co., Chicago, Ill.
Taylor Instrument Companies, Rochester, N. Y.

RECORDER-CONTROLLERS, HUMIDITY

●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
●Powers Regulator Co., Chicago, Ill.
Taylor Instrument Companies, Rochester, N. Y.

RECORDER-CONTROLLERS, TEMPERATURE

Bailey Meter Co., Cleveland, O.
●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
●Powers Regulator Co., Chicago, Ill.
Taylor Instrument Companies, Rochester, N. Y.

RECORDERS, COMBINED TEMPERATURE AND HUMIDITY

●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Inc., Julien P., Baltimore, Md.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.

RECORDERS, COMBUSTION

Bailey Meter Co., Cleveland, O.
●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Engelhard, Inc., Charles, Newark, N. J.
Foxboro Co., Foxboro, Mass.
Hays Corp., Michigan City, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Uehling Instrument Co., Paterson, N. J.

RECORDERS, DRAFT

Bailey Meter Co., Cleveland, O.
●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Foxboro Co., Foxboro, Mass.
Hays Corp., Michigan City, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Republic Flow Meters Co., Chicago, Ill.
Uehling Instrument Co., Paterson, N. J.

RECORDERS, HUMIDITY

●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Inc., Julien P., Baltimore, Md.
H-B Instrument Co., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

RECORDERS, LIQUID LEVEL

Bailey Meter Co., Cleveland, O.
●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Inc., Julien P., Baltimore, Md.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Mason-Neilan Regulator Co., Boston, Mass.
Morey & Jones, Ltd., Los Angeles, Calif.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.

RECORDERS, PRESSURE

Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Foxboro Co., Foxboro, Mass.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Star Brass Mfg. Co., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.

RECORDERS, TEMPERATURE

Bailey Meter Co., Cleveland, O.
●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Engelhard, Inc., Charles, Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Inc., Julien P., Baltimore, Md.
H-B Instrument Co., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
●Powers Regulator Co., Chicago, Ill.
●Practical Instrument Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.

RECORDERS, VACUUM

Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Foxboro Co., Foxboro, Mass.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Star Brass Mfg. Co., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.

RECORDING THERMOMETERS

See Thermometers, Recording

REDUCERS, SPEED

Ajax Flexible Coupling Co., Westfield, N. Y. (Fractional sizes —⅛ to 1 hp)
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Boston Gear Wks., Inc., North Quincy, Mass.
De Laval Steam Turbine Co., Trenton, N. J.
Diehl Mfg. Co., Elizabeth, N. J. (Helical, worm)
●General Electric Co., Schenectady, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 232.

Janette Mfg. Co., Chicago, Ill. (Motorized)
Jones Foundry Machine Co., W. A., Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Medart Co., St. Louis, Mo.
Morse Chain Co., Ithaca, N. Y. (Chain speed)
New Departure Div., General Motors Corp., Bristol, Conn.
Philadelphia Gear Co., Philadelphia, Pa.
Star Electric Motor Co., Bloomfield, N. J.
Poole Foundry & Machine Co. Baltimore Md.
Smith, Inc., Winfield H., Springville, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

REFRIGERANTS

Ansul Chemical Co., Marinette, Wis. (methyl chloride, sulphur dioxide)
Armour Ammonia Wks., Chicago, Ill. (ammonia)
Carbide & Carbon Chemicals Corp., New York, N. Y.
du Pont de Nemours & Co., E. I., R. & H. Chemicals Dept., Wilmington, Del. (methyl chloride)
Kinetic Chemicals, Inc., Wilmington, Del. ("Freon")
Liquid Carbonic Corp., Chicago, Ill. (carbon dioxide)
Pure Carbonic, Inc., New York, N. Y. (carbon dioxide)
Virginia Smelting Co., West Norfolk, Va. (methyl chloride)

REFRIGERATING COMPRESSORS

See Compressors, Refrigerating

REFRIGERATING VALVES

See Valves, Refrigerating

REFRIGERATION CONTROLS

See Valves, Refrigeration

REFRIGERATION FITTINGS

See Fittings, Refrigeration

REGISTERS

●Auer Register Co., Cleveland, O.
●Barber-Colman Co., Rockford, Ill.
Best Register Co., Milwaukee, Wis.
Diamond Mfg. Co., Wyoming, Pa.
Elsey Metal Specialties Co., Detroit, Mich.
Gillian Mfg. Co., Ferndale, Mich.
Hart & Cooley Mfg. Co., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
●Independent Register Co., Cleveland, O.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Knowles Mushroom Ventilator Co., New York, N. Y.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Register & Grille Mfg. Co., Brooklyn, N. Y.
Rock Island Register Co., Rock Island, Ill.
●Tuttle & Bailey, Inc., New Britain, Conn.
United States Register Co. Battle Creek, Mich.
●Waterloo Register Co., Waterloo, Ia.

REGULATORS, AIR VELOCITY

●Johnson Service Co., Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.

REGULATORS, DRAFT

●Air Conditioning Products Co., Detroit, Mich.
American Radiator Co., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Bailey Meter Co., Cleveland, O.
Boiler Room Equipment, Inc., New York, N. Y.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burrows Mfg. Co., F. A., York, Pa.
Carrick Engineering Co., Michigan City, Ind.
Cash Co., A. W., Decatur, Ill.
Cole-Sullivan Engineering Co., Minneapolis, Minn.
Crew-Sargent Controls, Inc., New York, N. Y.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Engineer Co., New York, N. Y.
Field Mfg. Co., Chicago, Ill.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
Hagan Corp., Pittsburgh, Pa.
Hotstream Heater Co., Cleveland, O.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
International Draft Control Co., Cleveland, O.
Kieley & Mueller, Inc., New York, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
Master Electric Co., Dayton, O.
Mercoid Corp., Chicago, Ill.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Corp., Dayton, O.
Republic Flow Meters Co., Chicago, Ill. (Industrial)
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., Inc., New York, N. Y.
Shallcross Controls, Inc., Milwaukee, Wis.
Sheer Co., H. M., Quincy, Ill.
Spence Engineering Co., Inc., Walden, N. Y.
United Electric Controls Co., Boston, Mass.
●Webster & Co., Warren, Camden, N. J.

REGULATORS, PRESSURE, GAS

Barber Gas Burner Co., Cleveland, O.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Bryant Heater Co., Cleveland, O.
Brown Instrument Co., Div. of Minneapolis-Regulator Co., Philadelphia, Pa.
Burdett Mfg. Co., Chicago, Ill.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Cooper Co., Clark, Philadelphia, Pa.
Davis Regulator Co., Chicago, Ill.
d'Este Co., Julian, Charlestown, Mass.
Eclipse Fuel Engineering Co., Rockford, Ill.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Inc., Julien P., Baltimore, Md.
●Fulton Sylphon Co., Knoxville, Tenn.
●General Controls Co., San Francisco, Cal.
Harris Calorific Co., Cleveland, O.
●Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
●Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Milburn Co., Alexander, Baltimore, Md.
Monitor Controller Co., Baltimore, Md.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal. (Low)
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
●Powers Regulator Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill. (Industrial)
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Sheer Co., H. M., Quincy, Ill.
Spence Engineering Co., Inc., Walden, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Detroit, Mich.
Strong, Carlisle & Hammond Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.

REGULATORS, PRESSURE, HOT WATER HEATING SYSTEMS

Beaton & Cadwell Mfg. Co., New Britain, Conn.
Belfield Co., H., Philadelphia, Pa.
●Bell & Gossett Co., Chicago, Ill.
Bordo Co., Inc., L. J., Glenside, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Cooper Co., Clark, Philadelphia, Pa.
d'Este Co., Julian, Charlestown, Mass.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
●Fulton Sylphon Co., Knoxville, Tenn.
Kainer Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Leslie Co., Lyndhurst, N. J.
Maid-O-Mist, Inc., Chicago, Ill.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Penberthy Injector Co., Detroit, Mich.
Republic Flow Meters Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Stevens-Root Co., Chicago, Ill.
Strong, Carlisle & Hammond Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.
Triplex Mfg. Co., Peru, Ind.
Tryco Products, Inc., Westfield, Mass.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, PRESSURE, LIQUID

Atlas Valve Co., Inc., Newark, N. J.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago,, Ill.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Cash Co., A. W., Decatur, Ill.
Central Brass Mfg. Co., Cleveland, O.
Cooper Co., Clark, Philadelphia.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.

●Advertisement in this issue. See Index to Advertisers, page 232.

●Fulton Sylphon Co., Knoxville, Tenn.
Healy Ruff Co., St. Paul, Minn.
●Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Locke Regulator Co., Salem, Mass.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Nason-Neilan Regulator Co., Boston, Mass.
Mercoid Corp., Chicago, Ill.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
Monitor Controller Co., Baltimore, Md.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schaphorst, W. F., Newark, N. J.
Schutte & Koerting Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Spence Engineering Co., Inc., Walden, N. Y.
Square D Co., Detroit, Mich.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Tryco Products, Inc., Westfield, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, PRESSURE, STEAM

●American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Bailey Meter Co., Cleveland, O.
Belfield Co., H., Philadelphia, Pa.
●Bell & Gossett Co., Chicago, Ill.
Boylston Steam Specialty Co., Chicago, Ill.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burrows Mfg. Co., F. A., York, Pa.
Cash Co., A. W., Decatur, Ill.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Cooper Co., Clark, Philadelphia.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
●Dunham Co., C. A., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Engineer Co., New York, N. Y.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
●Fulton Sylphon Co., Knoxville, Tenn.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Gorton Heating Corp., Cranford, N. J.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Kisco Co., Inc., St. Louis, Mo.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Monitor Controller Co., Baltimore, Md.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill.
Schade Valve Mfg. Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Spence Engineering Co., Inc., Walden, N. Y.
Squires Co., C. E., Cleveland, O.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
United Electric Controls Co., Boston, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Williams Gauge Co., Pittsburgh, Pa.

REGULATORS, STATIC PRESSURE

Eclipse Fuel Engineering Co., Rockford, Ill.
Foster Engineering Co., Newark, N. J.
●Johnson Service Co., Milwaukee, Wis.
Mason-Neilan Regulator Co., Boston, Mass.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
●Powers Regulator Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill.

REGULATORS, TEMPERATURE

American Radiator Co., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
●Barber-Colman Co., Rockford, Ill.
●Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burling Instrument Co., Newark, N. J.
Cook Electric Co., Chicago, Ill.
Cooper Co., Clark, Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
Eclipse Fuel Engineering Co., Rockford, Ill.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
●General Controls Co., San Francisco, Cal.
H-B Instrument Co., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Keckley Co., O. C., Chicago, Ill.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.
Leonard Valve Co., Providence, R. I.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Mercoid Corp., Chicago, Ill.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
Ranco, Inc., Columbus, O.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., Inc., New York, N. Y.
Spence Engineering Co., Inc., Walden, N. Y.
Spencer Thermostat Co, Attleboro, Mass.
Square D Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y
Taylor Instrument Companies, Rochester, N. Y.
Watson & McDaniel Co., Philadelphia, Pa.
White Mfg. Co., St. Paul, Minn.

RELAYS, ELECTRICAL

●Allen-Bradley Co., Milwaukee, Wis.
●Automatic Products Co., Milwaukee, Wis.
Automatic Switch Co., New York, N. Y.
●Bell & Gossett Co., Chicago, Ill.
Bender Warrick Corp., Birmingham, Mich.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Clark Controller Co., Cleveland, O.
Cutler-Hammer, Inc., Milwaukee, Wis.
Dunn, Inc., Struthers, Philadelphia, Pa.
Durakool, Inc., Elkhart, Ind.
Electric Controller & Mfg. Co., Cleveland, O.
Friez & Sons, Inc., Julien P., Baltimore, Md.
●General Controls Co., San Francisco, Cal.
●General Electric Co., Schenectady, N. Y.
H-B Instrument Co., Philadelphia, Pa.
●Hart Mfg. Co., Hartford, Conn.
McCorkle Co., D. H., Berkeley, Calif.
Mercoid Corp., Chicago, Ill.
Monitor Controller Co., Baltimore, Md.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Spencer Thermostat Co., Attleboro, Mass.
Thrush & Co., H. A., Peru, Ind.
Tork Clock Co., Inc., Mount Vernon, N. Y.
Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa
Weston Electrical Instrument Corp., Newark, N. J.
White Mfg. Co., St. Paul, Minn.

RELIEF VALVES

See Valves, Relief

REPAIR CLAMPS, PIPE

See Clamps, Pipe Repair

REVOLVING DOORS

See Doors, Revolving

ROD, WELDING

Air Reduction Sales Co., New York, N. Y.
●American Brass Co., Waterbury, Conn.
American Chain & Cable Co., Inc., Bridgeport, Conn.
American Steel & Wire Co., Cleveland, O.
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.

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Crucible Steel Co. of America, New York, N. Y.
Duraloy Co., Pittsburgh, Pa. (Stainless)
Imperial Brass Mfg. Co., Chicago, Ill.
Keasbey & Mattison Co., Ambler, Pa.
Laclede Steel Co., St. Louis, Mo.
●Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Maurath, Inc., Cleveland, O.
Milburn Co., Alexander, Baltimore, Md.
Page Steel & Wire Division of American Chain Co., Inc., Monessen, Pa.
●Republic Steel Corp., Cleveland, O.
Revere Copper & Brass, Inc., New York, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Seneca Wire & Mfg. Co., Fostoria, O.
Sight Feed Generator Co., Richmond, Ind.
Una Welding, Inc., E. Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

ROLLER BEARINGS
See Bearings, Roller

ROOF VENTILATORS
See Ventilators, Roof

ROOM HUMIDIFIERS
See Humidifiers, Unit, Room Type and Unit Air Humidifiers

ROOM THERMOSTATS
See Thermostats, Room or Wall

ROTARY PUMPS
See Pumps, Rotary

RUBBER BELTING
See Belting, Rubber

RUBBER PACKING
See Packing, Rubber

RUBBER PIPE
See Pipe, Hard Rubber

SEAMLESS PIPE
See Pipe, Seamless, Steel

SEPARATORS, AIR
Adams Co., R. P., Buffalo, N. Y.
Bubar, Hudson H., New York, N. Y.
Centrifix Corp., Cleveland, O.
●Crane Co., Chicago, Ill.
Direct Separator Co., Inc., Syracuse, N. Y.
●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
Kellogg Compressor & Mfg. Corp., Rochester, N. Y.
Leavitt Machine Co., Orange, Mass.
Logan Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ills.
Milburn Co., Alexander, Baltimore, Md.
Spray Engineering Co., Somerville, Mass.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Wright-Austin Co., Detroit, Mich.

SEPARATORS, STEAM AND OIL
Acme Industries, Inc., Jackson, Mich.
Adams Co., R. P., Buffalo, N. Y.
●Air-Maze Corp., Cleveland, O. (For diesel engines)
●American District Steam Co., North Tonawanda, N. Y.
Andrews Bradshaw Co., Blawnox, Pa.
Barrett Machine Co., N. S. Pittsburgh, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Centrifix Corp., Cleveland, O.
Cochrane Corp., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Direct Separator Co., Inc., Syracuse, N. Y.
Elliott Co., Jeannette, Pa.
Fisher Governor Co., Marshalltown, Ia.
●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
Kieley & Mueller, Inc., New York, N. Y.
Kisco Co., Inc., St. Louis, Mo.
Logan Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Morehead Mfg. Co., Detroit, Mich.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
●Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

SEWAGE EJECTORS
See Ejectors, Sewage

SHEARS, HAND
Armstrong-Blum Mfg. Co., Chicago, Ill.
Black & Decker Mfg. Co., Towson, Md.
Bremil Mfg. Co., Erie, Pa.
Champion Blower & Forge Co., Lancaster, Pa.
Clauss Shear Co., Fremont, O.
Hendley & Whittemore, Beloit, Wis.
Marshalltown Mfg. Co., Marshalltown, Ia.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Pels & Co., Inc., Henry, New York, N. Y.
Snap-On Tools, Inc., Kenosha, Wis.
Stanley Wks., New Britain, Conn.
Viking Shear Co., Erie, Pa.
Whitney Mfg. Co., W. A., Rockford, Ill.
Whitney Metal Tool Co., Rockford, Ill.
Wiss & Sons Co., J., Newark, N. J.

SHEARS, POWER
American Foundry Equipment Co., Mishawaka, Ind.
Bertsch & Co., Inc., Cambridge City, Ind.
●Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati, O.
Dreis & Krump Mfg. Co., Chicago, Ill.
Heartley Machine & Tool Co., Toledo, O.
Hendley & Whittemore, Beloit, Wis.
Marshalltown Mfg. Co., Marshalltown, Ia.
New Albany Machine Mfg. Co., New Albany, Ind.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Pels & Co., Inc., Henry, New York, N. Y.
Stanley Wks., New Britain, Conn.
●Torrington Mfg. Co., Torrington, Conn.
Verson Allsteel Press Co., Chicago, Ill.
Viking Pump Co., Cedar Falls, Ia.

SHEET METAL BRAKES
See Brakes, Sheet Metal

SHEET METAL DUCTS
See Ducts and Duct Fittings, Prefabricated

SHEET METAL FITTINGS
See Ducts and Duct Fittings, Prefabricated

SHEET METAL PUNCHES
See Punches, Sheet Metal

SHEETS, ALLOY
Allegheny Steel Co., Brackenridge, Pa.
●American Brass Co., Waterbury, Conn.
●American Rolling Mill Co., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Crucible Steel Co. of America, New York, N. Y.
Duraloy Co., Pittsburgh, Pa.
Duriron Co., Inc., Dayton, O.
Ingersoll Steel & Disc Co., Chicago, Ill.
International Nickel Co., New York, N. Y. (Monel)
Ludlum Steel Co., Watervliet, N. Y.
●Republic Steel Corp., Cleveland, O.
Revere Copper & Brass, Inc., New York, N. Y.
Scoville Mfg. Co., Waterbury, Conn.
Sharon Steel Corp., Sharon, Pa.

SHEETS, ALUMINUM
Aluminum Co. of America, Pittsburgh, Pa.
Fairmont Aluminum Co., Fairmont, W. Va.

SHEETS, COPPER
●American Brass Co., Waterbury, Conn.
American Nickeloid Co., Peru, Ind. (Chromium plated)
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
●Hussey & Co., C. G., Pittsburgh, Pa.
New Haven Copper Co., Seymour, Conn.
Revere Copper & Brass, Inc., New York, N. Y.
United States Brass & Copper Co., Hyde Park, Boston, Mass.

SHEETS, COPPER BEARING STEEL
●American Rolling Mill Co., Middletown, O.
Apollo Steel Co., Apollo, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Follansbee Bros. Co., Pittsburgh, Pa.
Granite City Steel Co., Granite City, Ill.
Gulf States Steel Co., Birmingham, Ala.
Inland Steel Co., Chicago, Ill.
Lukens Steel Co., Coatesville, Pa.
National Steel Corp., Pittsburgh, Pa.
Newport Rolling Mill Co., Newport, Ky.
Otis Steel Co., Cleveland, O.
Reeves Steel & Mfg. Co., Dover, O.
●Republic Steel Corp., Cleveland, O.
Sharon Steel Corp., Sharon, Pa.
Superior Sheet Steel Co., Canton, O.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
●Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS, IRON AND STEEL, GALVANIZED
American Nickeloid Co., Peru, Ind. (Chromium plated)
●American Rolling Mill Co., Middletown, O.
Apollo Steel Co., Apollo, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Byers Co., A. M., Pittsburgh, Pa. (Wrought iron)
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Continental Steel Corp., Kokomo, Ind.

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Crucible Steel Co. of America, New York, N. Y.
Follansbee Bros. Co., Pittsburgh, Pa.
Granite City Steel Co., Granite City, Ill.
Gulf States Steel Co., Birmingham, Ala.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Lukens Steel Co., Coatesville, Pa.
Lyon, Conklin & Co., Inc., Baltimore, Md.
National Steel Corp., Pittsburgh, Pa.
Newport Rolling Mill Co., Newport, Ky.
Niles Rolling Mill Co., Niles, O.
Reeves Steel & Mfg. Co., Dover, O.
●Republic Steel Corp., Cleveland, O.
Sharon Steel Corp., Sharon, Pa.
Superior Sheet Steel Co., Canton, O.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
●Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS, LEAD

Andrews Lead Co., Long Island City, N. Y.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.
Rochester Lead Wks., Rochester, N. Y.

SHEETS, TIN

Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Follansbee Bros. Co., Pittsburgh, Pa.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., Chicago, Ill.
Weirton Steel Co., Weirton, W. Va.
●Wheeling Steel Corp., Wheeling, W. Va.
●Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS, ZINC

American Nickeloid Co., Peru, Ind. (Chromium plated)
American Zinc Products Co., Greencastle, Ind.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Hegeler Zinc Co., Danville, Ill.
Illinois Zinc Co., Chicago, Ill.
Matthiessen & Hegeler Zinc Co., La Salle, Ill.
New Jersey Zinc Sales Co., New York, N. Y.

SLEEVE BEARINGS

See Bearings, Sleeve

SMOKE GUNS

See Guns and Pots, Smoke and Smudge

SMUDGE POTS

See Guns and Pots, Smoke and Smudge

SOLDER, BRAZING ALLOYS, AND FLUXES

Air Reduction Sales Co., New York, N. Y.
●American Brass Co., Waterbury, Conn.
American Solder & Flux Co., Philadelphia, Pa.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Benson Co., Inc., Alex R., Hudson, N. Y.
Burnley Battery & Mfg. Co., North East, Pa.
Eagle-Picher Lead Co., Cincinnati, O.
Gardiner Metal Co., Chicago, Ill.
Handy & Harman, New York, N. Y. (Silver)
Imperial Brass Mfg. Co., Chicago, Ill.
Kester Solder Co., Chicago, Ill.
●Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.
Ruby Chemical Co., Columbus, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SOLENOID VALVES

See Valves, Solenoid

SOOT BLOWERS

See Blowers, Soot

SOUND DEADENING, CEILING AND WALL

See Insulation, Sound Deadening, Ceiling and Wall

SOUND DEADENING FOR DUCTS

See Insulation, Sound Deadening, Duct

SOUND INDICATORS

See Indicators, Sound Level

SPEED REDUCERS

See Reducers, Speed

SPIRAL PIPE

See Pipe, Spiral, Riveted and Welded

SPOT WELDERS

See Welders, Spot

SPRAY HUMIDIFIERS

See Humidifiers, Direct, Spray Head

SPRAY NOZZLES

See Nozzles, Spray

SPRINKLER HEADS

See Heads, Sprinkler

STAINLESS SHEETS

See Sheets, Alloy

STANDS, VISE

American Pipe Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Hollands Mfg. Co., Erie, Pa.
Martin & Sons, H. P., Owensboro, Ky.
Nye Tool & Machine Wks., Chicago, Ill.
●Ridge Tool Co., Elyria, O.
Western Wire Products Co., St. Louis, Mo.
●Williams & Co., J. H., New York, N. Y.

STARTERS, MOTOR

See Controllers and Starters, Motor

STEAM EJECTORS

See Compressors, Refrigerating, Steam Jet

STEAM ENGINES

See Engines, Steam

STEAM JET REFRIGERATION

See Compressors, Refrigerating, Steam Jet

STEAM PRESSURE REGULATORS

See Regulators, Pressure, Steam

STEAM PUMPS

See Pumps, Steam

STEAM SEPARATORS

See Separators, Steam and Oil

STEAM TRAPS

See Traps, Steam

STEEL PIPE

See Pipe, Steel

STEEL TUBING

See Tubing, Steel

STEEL UNIONS

See Unions, Steel

STEEL VALVES

See Valves, Gate and Valves, Globe

STOCKS AND DIES

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
●Beaver Pipe Tools, Inc., Warren, O.
Champion Blower & Forge Co., Lancaster, Pa.
Erie Tool Wks., Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hollands Mfg. Co., Erie, Pa.
Jarecki Mfg. Co., Erie, Pa.
Nye Tool & Machine Wks., Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
●Ridge Tool Co., Elyria, O.
Toledo Pipe Threading Machine Co., Toledo, O.
Trimont Mfg. Co., Boston, Mass.
●Walworth Co., New York, N. Y.

STOKERS, INDUSTRIAL AND COMMERCIAL

American Coal Burner Co., Chicago, Ill.
Anchor Stove & Range Co., New Albany, Ind.
Auburn Foundry, Inc., Stoker Div., Auburn, Ind.
Automatic Stoker Corp., Milwaukee, Wis.
Babcock & Wilcox Co., New York, N. Y.
Bluffton Mfg. Co., Findlay, O.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
Burke Stoker & Mfg. Co., Chicago, Ill.
Burnham Stoker Co., Vancouver, Wash.
Butler Mfg. Co., Kansas City, Mo.
Canton Stoker Corp., Canton, O.
Carnes, Inc., John R., Lima, O.
Christensen Machine Co., Salt Lake City, Utah.
Columbus Metal Products Co., Columbus, O.
Combustion Engineering Co., Inc., New York, N. Y.
Conco-Sampsel Stoker Corp., Mendota, Ill.
Delta Stoker Co., Chicago, Ill.
●Detroit Stoker Co., Detroit, Mich.
Econocol Stoker Div. of Cotta Transmission Corp., Rockford, Ill.
Eddy Stoker Corp., Chicago, Ill.
Fairbanks-Morse & Co., Chicago, Ill.
Firemood Machine Wks., Converse, Ind.
Flynn & Emrich Co., Baltimore, Md.
Frederick Iron & Steel Co., Frederick, Md.
Fuel Savers, Inc., Harrisburg, Pa.
Gehl Bros. Mfg. Co., West Bend, Wis.
Heating Assurance, Inc., Spokane, Wash.
Her-Born Engrg. & Mfg. Co., Sandusky, O.
Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.
Hoffman Combustion Engineering Co., Detroit, Mich.
Holcomb & Hoke Mfg. Co., Indianapolis, Ind.
Illinois Iron & Bolt Co., Chicago, Ill.
International Engineering Wks., Inc., Framingham, Mass.
Iron Fireman Mfg. Co., Cleveland, O.

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Johnston & Jennings Co., Cleveland, O.
Jordan & Co., Paul R., Indianapolis, Ind.
Laclede Stoker Co., St. Louis, Mo.
Link-Belt Co., Chicago, Ill.
Mallory Sales Co., Dolton, Ill.
Marion Machine Foundry & Supply Co., Marion, Ind.
McClave-Brooks Co., Scranton, Pa.
Muncie Gear Wks., Inc., Muncie, Ind.
National Steam Pump Co., Upper Sandusky, O.
Neemes Foundry, Inc., Troy, N. Y.
Norge Heating & Conditioning Div., Borg-Warner Corp., Detroit, Mich.
Paragon Kol-Master Corp., Oregon, Ill.
Patterson Foundry & Machine Co., East Liverpool, O.
Perfection Grate & Stoker Co., Springfield, Mass.
Redi Automatic Coal Burners, Inc., Spokane, Wash.
Riley Stoker Corp., Worcester, Mass.
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Schwitzer-Cummins Co., Indianapolis, Ind.
Sinker-Davis Co., Indianapolis, Ind.
Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa.
Steel Products Engineering Co., Springfield, O.
Stokermatic Co., Salt Lake City, Utah.
Stokers, Inc., Detroit, Mich.
Taylor Engineering Co., Cincinnati, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Whiting Corp., Harvey, Ill.
Will-Burt Co., Orrville, O.

STONEWARE PIPE

See Pipe, Stoneware

STORAGE WATER HEATERS

See Heaters, Water, Storage

STRAINERS, PIPE LINE

●American District Steam Co., North Tonawanda, N. Y.
American Injector Co., Detroit, Mich.
Barrett, Haentjens & Co., Hazelton, Pa.
●Blackmer Pump Co., Grand Rapids, Mich.
Buffalo Meter Co., Buffalo, N. Y.
Boylston Steam Specialty Co., Chicago, Ill.
Cash Co., A. W., Decatur, Ill.
Cashin Co., W. D., Boston, Mass.
Central Brass Mfg. Co., Cleveland, O.
●Crane Co., Chicago, Ill.
Cuno Engineering Corp., Meriden, Conn.
Davis Regulator Co., Chicago, Ill.
Direct Separator Co., Inc., Syracuse, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Elliott Co., Jeannette, Pa.
Fisher Governor Co., Marshalltown, Ia.
●Grinnell Co., Providence, R. I.
●Henry Valve Co., Chicago, Ill.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Kaye & MacDonald, Inc., West Orange, N. J.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, New York, N. Y.
Leslie Co., Lyndhurst, N. J.
McAlear Mfg. Co., Chicago, Ill.
●Milwaukee Valve Co., Milwaukee, Wis.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., New York, N. Y.
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
●Sarco Co., New York, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Spence Engineering Co., Walden, N. Y.
Spray Engineering Co., Somerville, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Sterling Engineering Co., Milwaukee, Wis.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
●Trane Co., La Crosse, Wis.
Tryco Products, Inc., Westfield, Mass.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

STRIP HEATERS

See Heaters, Strip and Immersion, Electric

SUMP PUMPS

See Pumps, Sump

SURFACE, COOLING, BRINE

Acme Industries, Inc., Jackson, Mich.
Advanced Engineering Co., Philadelphia, Pa.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
●Bush Mfg. Co., Hartford, Conn.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
●Frick Co., Waynesboro, Pa.
●G. & O. Mfg. Co., New Haven, Conn.
Lewis & Co., Joseph E., Baltimore, Md.
Manufacturers Fin Coil Co., Chicago, Ill.
Marlo Coil Co., St. Louis, Mo.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Mojonnier Bros. Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Peerless of America, Inc., Chicago, Ill.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
●Refrigeration Appliances, Inc., Chicago, Ill.
Reliance Refrigerating Machine Co., Chicago, Ill.
●Rempe Co., Chicago, Ill.
Standard Galvanizing Co., Chicago, Ill.
●Sturtevant Co., B. F., Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Thermal Units Mfg. Co., Meriden, Conn.
●Trane Co., La Crosse, Wis.
Trenton Auto Radiator Wks., Trenton, N. J.
●Unit Heater & Cooler Co., Wausau, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
●Westinghouse Electric & Mfg. Co., Mansfield, O.
●Wing Mfg. Co., L. J., New York, N. Y.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

SURFACE, COOLING, COLD WATER

Acme Industries, Inc., Jackson, Mich.
Adams Co., R. P., Buffalo, N. Y.
Advanced Engineering Co., Philadelphia, Pa.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
American Radiator Co., New York, N. Y.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Beacon-Morris Corp., Boston, Mass.
●Bush Mfg. Co., Hartford, Conn.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
●Frick Co., Waynesboro, Pa.
●G. & O. Mfg. Co., New Haven, Conn.
●General Electric Co., Schenectady, N. Y.
Heat Transfer Co., Huntington, Ind.
Hexcel Radiator Co., Racine, Wis.
●Johnson Fan & Blower Corp., Chicago, Ill.
Larkin Refrigerating Corp., Atlanta, Ga.
Lewis & Co., Joseph E., Baltimore, Md.
Manufacturers Fin Coil Co., Chicago, Ill.
Marlo Coil Co., St. Louis, Mo.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Mojonnier Bros. Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Peerless of America, Inc., Chicago, Ill.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
●Refrigeration Appliances, Inc., Chicago, Ill.
Reliance Refrigerating Machine Co., Chicago, Ill.
●Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
●Sturtevant Co., B. F., Boston, Mass.
Standard Galvanizing Co., Chicago, Ill.
Star Radiator Co., Los Angeles, Cal.
Super Radiator Corp., Minneapolis, Minn.
Thermal Units Mfg. Co., Meriden, Conn.
●Trane Co., La Crosse, Wis.
Trenton Auto Radiator Wks., Trenton, N. J.
●Unit Heater & Cooler Co., Wausau, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Wing Mfg. Co., L. J., New York, N. Y.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

SURFACE, COOLING, DIRECT EXPANSION

Acme Industries, Inc., Jackson, Mich.
Adams Co., R. P., Buffalo, N. Y.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Beacon-Morris Corp., Boston, Mass.
●Bush Mfg. Co., Hartford, Conn.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●Frick Co., Waynesboro, Pa.
●G. & O. Mfg. Co., New Haven, Conn.
●General Electric Co., Schenectady, N. Y.
General Refrigeration Corp., Beloit, Wis.
Hardy Mfg. Co., Inc., Dayton, O.
Ilg Electric Ventilating Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Larkin Refrigerating Corp., Atlanta, Ga.
Lewis & Co., Joseph E., Baltimore, Md.
Manufacturers Fin Coil Co., Chicago, Ill.
Marlo Coil Co., St. Louis, Mo.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Mojonnier Bros. Co., Chicago, Ill.
National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., Minneapolis, Minn.
Niagara Blower Co., New York, N. Y.

●Advertisement in this issue. See Index to Advertisers, page 232.

Peerless of America, Inc., Chicago, Ill.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
Reliance Refrigerating Machine Co., Chicago, Ill.
●Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Standard Galvanizing Co., Chicago, Ill.
●Sturtevant Co., B. F., Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Thermal Units Mfg. Co., Meriden, Conn.
●Trane Co., La Crosse, Wis.
Trenton Auto Radiator Wks., Trenton, N. J.
Triumph Ice Machine Co., Cincinnati, O.
●Unit Heater & Cooler Co., Wausau, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

SURFACE, HEATING, FERROUS

American Radiator Co., New York, N. Y.
Bayley Blower Co., Milwaukee, Wis.
●Burnham Boiler Co., Irvington, N. Y.
Shaw-Perkins Co., Pittsburgh, Pa.
●Unit Heater & Cooler Co., Wausau, Wis.
Wolff & Munier, Inc., New York, N. Y. (For panel heating)

SURFACE, HEATING, NON-FERROUS

●Aerofin Corp., Syracuse, N. Y.
American Radiator Co., New York, N. Y.
Bayley Blower Co., Milwaukee, Wis.
Beacon-Morris Corp., Boston, Mass.
●Bush Mfg. Co., Hartford, Conn.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●G. & O. Mfg. Co., New Haven, Conn.
●General Electric Co., Schenectady, N. Y.
Hexcel Radiator Co., Racine, Wis.
●Johnson Fan & Blower Corp., Chicago, Ill.
Manufacturers Fin Coil Co., Chicago, Ill.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, Moline, Ill.
●Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
Niagara Blower Co., New York, N. Y.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
●Refrigeration Appliances, Inc., Chicago, Ill.
●Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Star Radiator Co., Los Angeles, Cal.
●Sturtevant Co., B. F., Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Thermal Units Mfg. Co., Meriden, Conn.
●Trane Co., La Crosse, Wis.
Trenton Auto Radiator Wks., Trenton, N. J.
●Unit Heater & Cooler Co., Wausau, Wis.
●Westinghouse Electric & Mfg. Co., Mansfield, O.
Winchester Repeating Arms Co., New Haven, Conn.
●Wing Mfg. Co., L. J., New York, N. Y.
●Young Radiator Co., Racine, Wis.

SURFACE THERMOSTATS

See Thermostats, Surface

SWITCHES, ELECTRICAL

Adam Electric Co., Frank, St. Louis, Mo.
●Allen-Bradley Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Elect. Co., Hartford, Conn.
Automatic Switch Co., New York, N. Y.
Clark Controller Co., Cleveland, O.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
Delta-Star Electric Co., Chicago, Ill.
Dunn, Inc., Struthers, Philadelphia, Pa.
Durakool, Inc., Elkhart, Ind. (Mercury)
Electric Controller & Mfg. Co., Cleveland, O.
●General Electric Co., Schenectady, N. Y.
●Hart Mfg. Co., Hartford, Conn.
Jefferson Electric Co., Bellwood, Ill. (Mercury)
Marsh Corp., Jas. P., Chicago, Ill.
Mercoid Corp., Chicago, Ill. (Mercury)
Micro Switch Corp., Freeport, Ill.
Penn Electric Switch Co., Goshen, Ind.
Square D Co., Detroit, Mich.
Tork Clock Co., Inc., Mount Vernon, N. Y.
Trumbull Electric Mfg. Co., Plainville, Conn.
Ward Leonard Electric Co., Mount Vernon, N. Y.
Webster Electric Co., Racine, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
White Mfg. Co., St. Paul, Minn.

SWITCHES, FLOAT, REFRIGERATION

●Alco Valve Co., Inc., St. Louis, Mo.
●Frick Co., Waynesboro, Pa.
Kisco Co., Inc., St. Louis, Mo.
McDonell & Miller, Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.

SWITCHES, LIQUID LEVEL

●Allen-Bradley Co., Milwaukee, Wis.
Bender Warrick Corp., Birmingham, Mich.
Cissell Mfg. Co., W. M., Louisville, Ky.
Clark Controller Co., Cleveland, O.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
●General Electric Co., Schenectady, N. Y.
●Hart Mfg. Co., Hartford, Conn.
McDonnell & Miller, Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Square D Co., Detroit, Mich.
Trumbull Electric Mfg. Co., Plainville, Conn.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SWITCHES, PRESSURE AND VACUUM

●Allen-Bradley Co., Milwaukee, Wis.
Boston Auto Gage Co., Pittsfield, Mass.
Clark Controller Co., Cleveland, O.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
●General Electric Co., Schenectady, N. Y.
Marsh Corp., Jas. P., Chicago, Ill.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Detroit, Mich.
Trumbull Electric Mfg. Co., Plainville, Conn.
Uniflow Mfg. Co., Erie, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SWITCHES, TIME

●Detroit Luubricator Co., Detroit, Mich.
Electro Hot Heater Co., Tacoma, Wash.
●General Controls Co., San Francisco, Cal.
●General Electric Co., Schenectady, N. Y.
Paragon Electric Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Rhodes, Inc., M. H., New York, N. Y.
Sangamo Electric Co., Springfield, Ill.
Spencer Thermostat Co., Attleboro, Mass.
Tallmadge & Co., Webster, East Orange, N. J.
Tork Clock Co., Inc., Mount Vernon, N. Y.

SYSTEMS, HEATING, HOT WATER

●Bell & Gossett Co., Chicago, Ill.
General Fittings Co., Providence, R. I.
Kainer & Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Stevens-Root Co., Chicago, Ill.
Thrush & Co., H. A., Peru, Ind.
Triplex Mfg. Co., Peru, Ind.
Watts Regulator Co., Lawrence, Mass.

SYSTEMS, HEATING, VACUUM

American Radiator Co., New York, N. Y.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Cashin, W. D., Boston, Mass.
●Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
Marsh Corp., Jas. F., Chicago, Ill.
Marsh Tritrol Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
●Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
●Sarco Co., Inc., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

SYSTEMS, HEATING, ZONE CONTROL

●Dunham Co., C. A., Chicago, Ill.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Marsh Tritrol Co., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn
Raymond Co., F. I., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Tallmadge & Co., Webster, East Orange, N. J.
Thrush & Co., H. A., Peru, Ind.
●Webster & Co., Warren, Camden, N. J.

TANKS

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Bigelow Co., New Haven, Conn.
Biggs Boiler Wks. Co., Akron, O.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
Buffalo Tank Co., Arlington, Staten Island, N. Y.

●Advertisement in this issue. See Index to Advertisers, page 232.

- ●Burnham Boiler Corp., Irvington, N. Y.
- Caldwell Co., W. E., Louisville, Ky.
- Case & Son Mfg. Co., W. A., Buffalo, N. Y.
- Chicago Bridge & Iron Wks., Chicago, Ill.
- Columbian Steel Tank Co., Kansas City, Mo.
- Connery Construction Co., Philadelphia, Pa.
- Continental Diamond Fibre Co., Newark, Del.
- Copper Boilers, Inc., New York, N. Y.
- ●Curtis Refrigerating Machine Co., St. Louis, Mo.
- Dahlquist Mfg. Co., Inc., Boston, Mass.
- Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
- Dillon Steam Boiler Wks., Inc., D. M., Fitchburg, Mass.
- Downingtown Iron Wks., Downingtown, Pa.
- Eclipse Fuel Engineering Co., Rockford, Ill.
- Falstrom Co., Passaic, N. J.
- Farquhar Co., Ltd., A. B., York, Pa.
- Farrar & Trefts, Buffalo, N. Y.
- ●Frick Co., Waynesboro, Pa.
- Gerstein & Cooper Co., South Boston, Mass.
- Graver Tank & Mfg. Co., Inc., East Chicago, Ind.
- Hamburg Boiler Wks., Inc., Hamburg, Pa.
- Harris & Co., Arthur, Chicago, Ill.
- International Boiler Wks. Co., East Stroudsburg, Pa.
- International Engineering Wks., Framingham, Mass.
- ●Kewanee Boiler Corp., Kewanee, Ill.
- Kirk & Blum Mfg. Co., Cincinnati, O.
- Kisco Co., Inc., St. Louis, Mo.
- Koven & Bro., L. O., Jersey City, N. J.
- La Crosse Tractor Co., La Crosse, Wis.
- Manitowoc Boiler Wks., Manitowoc, Wis.
- Mauck Seamless Copper Tank Co., Victor, Norristown, Pa. (Copper)
- Maxweld Corp., Brooklyn, N. Y.
- Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
- Murray Iron Wks. Co., Burlington, Ia.
- Pfaudler Co., Rochester, N. Y. (Glass lined steel)
- Quaker City Iron Wks., Philadelphia, Pa.
- Richmond Engineering Co., Richmond, Va.
- Riverside Boiler Wks., Inc., Cambridge, Mass.
- Roessing Mfg. Co., Pittsburgh, Pa.
- Scaife & Sons Co., Wm. B., Oakmont, Pa.
- Strandwitz & Co., Inc., Camden, N. J.
- ●Titusville Iron Wks. Co., Titusville, Pa.
- Trageser Steam Copper Wks., John, Maspeth, Long Island, N. Y.
- Uniflow Mfg. Co., Erie, Pa.
- Walsh-Holyoke Steam Boiler Co., Holyoke, Mass.
- ●Wheeling Steel Corp., Wheeling, W. Va. (Heater)
- ●Whitlock Coil Pipe Co., Hartford, Conn.

TEMPERATURE RECORDERS

See Recorders, Temperature

TEMPERATURE REGULATORS

See Regulators, Temperature

THERMOMETERS, INDICATING, INDUSTRIAL

- American Thermometer Co., St. Louis, Mo.
- ●Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
- Foxboro Co., Foxboro, Mass.
- Friez & Sons, Inc., Julien P., Baltimore, Md.
- G. M. Mfg. Co., New York, N. Y.
- H-B Instrument Co., Philadelphia, Pa.
- ●Hill, E. Vernon, Chicago, Ill.
- Ideal Commutator Dresser Co., Sycamore, Ill.
- ●Illinois Testing Laboratories, Inc., Chicago, Ill.
- ●Johnson Service Co., Milwaukee, Wis.
- Leeds & Northrup Co., Philadelphia, Pa.
- Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Marsh Corp., Jas. P., Chicago, Ill.
- Martocello & Co., Jos. A., Philadelphia, Pa.
- Mason-Neilan Regulator Co., Boston, Mass.
- Moeller Instrument Co., Richmond Hill, N. Y.
- Palmer Co., Cincinnati (Norwood), O.
- Philadelphia Thermometer Co., Philadelphia, Pa.
- ●Powers Regulator Co., Chicago, Ill.
- Pyrometer Instrument Co., New York, N. Y.
- Scientific Instrument Co., Detroit, Mich.
- Standard Thermometer, Inc., Boston, Mass.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- Taylor Instrument Companies, Rochester, N. Y.
- Trerice Co., H. O., Detroit, Mich.
- United States Gauge Co., New York, N. Y.
- Weston Electrical Instrument Corp., Newark, N. J.

THERMOMETERS, INDICATING, REMOTE-READING

- ●Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Builders Iron Foundry, Providence, R. I.
- Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
- Foxboro Co., Foxboro, Mass.
- Friez & Sons, Inc., Julien P., Baltimore, Md.
- H-B Instrument Co., Philadelphia, Pa.
- ●Illinois Testing Laboratories, Inc., Chicago, Ill.
- ●Johnson Service Co., Milwaukee, Wis.
- Leeds & Northrup Co., Philadelphia, Pa.
- Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Marsh Corp., Jas. P., Chicago, Ill.
- Mason-Neilan Regulator Co., Boston, Mass.
- Moeller Instrument Co., Richmond Hill, N. Y.
- ●Powers Regulator Co., Chicago, Ill.
- ●Sarco Co., Inc., New York, N. Y.
- Standard Thermometer, Inc., Boston, Mass.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- Taylor Instrument Companies, Rochester, N. Y.
- Thwing-Albert Instrument Co., Philadelphia, Pa.
- Trerice Co., H. O., Detroit, Mich.
- United States Gauge Co., New York, N. Y.

THERMOMETERS, INDICATING, WALL

- American Thermometer Co., St. Louis, Mo.
- ●Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
- Engelhard Inc., Charles, Newark, N. J.
- Fee and Stemwedel, Inc., Chicago, Ill.
- Friez & Sons, Inc., Julien P., Baltimore, Md.
- G. M. Mfg. Co., New York, N. Y.
- H-B Instrument Co., Philadelphia, Pa.
- ●Hill, E. Vernon, Chicago, Ill.
- ●Illinois Testing Laboratories, Inc., Chicago, Ill.
- Leeds & Northrup Co., Philadelphia, Pa.
- Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Marsh Corp., Jas. P., Chicago, Ill.
- Martocello & Co., Jos. A., Philadelphia, Pa.
- Mason-Neilan Regulator Co., Boston, Mass.
- Moeller Instrument Co., Richmond Hill, N. Y.
- Parsons, John R., New York, N. Y. (Effective temperature indicator)
- Philadelphia Thermometer Co., Philadelphia, Pa.
- Scientific Instrument Co., Detroit, Mich.
- Standard Thermometer, Inc., Boston, Mass.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- Taylor Instrument Companies, Rochester, N. Y.
- Trerice Co., H. O., Detroit, Mich.
- United States Gauge Co., New York, N. Y.
- Weston Electrical Instrument Corp., Newark, N. J.

THERMOMETERS, RECORDING

- Bailey Meter Co., Cleveland, O.
- ●Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
- Engelhard Inc., Charles, Newark, N. J.
- Foxboro Co., Foxboro, Mass.
- Friez & Sons, Inc., Julien P., Baltimore, Md.
- H-B Instrument Co., Philadelphia, Pa.
- Leeds & Northrup Co., Philadelphia, Pa.
- Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Marsh Corp., Jas. P., Chicago, Ill.
- Mason-Neilan Regulator Co., Boston, Mass.
- Moeller Instrument Co., Richmond Hill, N. Y.
- ●Practical Instrument Co., Chicago, Ill.
- ●Powers Regulator Co., Chicago, Ill.
- Republic Flow Meters Co., Chicago, Ill.
- Standard Thermometer, Inc., Boston, Mass.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- Taylor Instrument Companies, Rochester, N. Y.
- Trerice Co., H. O., Detroit, Mich.

THERMOSTATIC BI-METALS

See Bi-Metals, Thermostatic

THERMOSTATIC TRAPS

See Traps, Steam, Thermostatic

THERMOSTATS, DUCT TYPE

- ●Barber-Colman Co., Rockford, Ill.
- ●Bell & Gossett Co., Chicago, Ill.
- ●Bristol Co., Waterbury, Conn.
- Cook Electric Co., Chicago, Ill.
- ●Detroit Lubricator Co., Detroit, Mich.
- Edison, Inc., Thomas A., Edison Electric Controls Div., West Orange, N. J.
- Foxboro Co., Foxboro, Mass.
- Friez & Sons, Inc., Julien P., Baltimore, Md.
- ●Hart Mfg. Co., Hartford, Conn.
- ●Hill, E. Vernon, Chicago, Ill.
- Jefferson Electric Co., Bellwood, Ill.
- ●Johnson Service Co., Milwaukee, Wis.
- Mercoid Corp., Chicago, Ill.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
- Penn Electric Switch Co., Goshen, Ind.
- Perfex Corp. (Controls Div.), Milwaukee, Wis.
- Philadelphia Thermometer Co., Philadelphia, Pa.
- ●Powers Regulator Co., Chicago, Ill.
- ●Sarco Co., New York, N. Y.
- Sheer Co., H. M., Quincy, Ill.
- Spencer Thermostat Co., Attleboro, Mass.
- Standard Thermometer, Inc., Boston, Mass.
- Superstat Co., Springfield, Mass.
- Tallmadge & Co., Webster, East Orange, N. J.

●Advertisement in this issue. See Index to Advertisers, page 232.

THERMOSTATS, EFFECTIVE TEMPERATURE

- ●Barber-Colman Co., Rockford, Ill.
- ●Johnson Service Co., Milwaukee, Wis.
- Friez & Sons, Inc., Julien P., Baltimore, Md.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- ●Powers Regulator Co., Chicago, Ill.

THERMOSTATS, IMMERSION

- ●Barber-Colman Co., Rockford, Ill.
- ●Bell & Gossett Co., Chicago, Ill.
- ●Detroit Lubricator Co., Detroit, Mich.
- Dunn, Inc., Struthers, Philadelphia, Pa.
- Edison, Inc., Thomas A., Edison Electric Controls Div., West Orange, N. J.
- Foxboro Co., Foxboro, Mass.
- Friez & Sons, Inc., Julien P., Baltimore, Md.
- ●Hart Mfg. Co., Hartford, Conn.
- H-B Instrument Co., Philadelphia, Pa.
- Jefferson Electric Co., Bellwood, Ill.
- ●Johnson Service Co., Milwaukee, Wis.
- Leslie Co., Lyndhurst, N. J.
- Mercoid Corp., Chicago, Ill.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
- Penn Electric Switch Co., Goshen, Ind.
- Perfex Corp. (Controls Div.), Milwaukee, Wis.
- ●Powers Regulator Co., Chicago, Ill.
- ●Sarco Co., Inc., New York, N. Y.
- Spencer Thermostat Co., Attleboro, Mass.
- Superstat Co., Springfield, Mass.
- Thrush & Co., H. A., Peru, Ind.
- Wilcolator Co., Newark, N. J.

THERMOSTATS, REMOTE CONTROL

- ●Barber-Colman Co., Rockford, Ill.
- ●Bristol Co., Waterbury, Conn.
- ●Detroit Lubricator Co., Detroit, Mich.
- Foxboro Co., Foxboro, Mass.
- Friez & Sons, Inc., Julien P., Baltimore, Md.
- ●Hart Mfg. Co., Hartford, Conn.
- ●Illinois Engineering Co., Chicago, Ill.
- Jefferson Electric Co., Bellwood, Ill.
- ●Johnson Service Co., Milwaukee, Wis.
- Mercoid Corp., Chicago, Ill.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
- Penn Electric Switch Co., Goshen, Ind.
- ●Powers Regulator Co., Chicago, Ill.
- ●Sarco Co., Inc., New York, N. Y.
- Wilcolator Co., Newark, N. J.

THERMOSTATS, ROOM OR WALL

- ●Automatic Products Co., Milwaukee, Wis.
- ●Barber-Colman Co., Rockford, Ill.
- ●Bell & Gossett Co., Chicago, Ill.
- ●Bristol Co., Waterbury, Conn.
- Cook Electric Co., Chicago, Ill.
- Crise Elec. Mfg. Co., Mt. Vernon, O.
- ●Detroit Lubricator Co., Detroit, Mich.
- Friez & Sons, Inc., Julien P., Baltimore, Md.
- ●General Controls Co., San Francisco, Cal.
- Gleason-Avery, Inc., Auburn, N. Y.
- Jefferson Electric Co., Bellwood, Ill.
- ●Johnson Service Co., Milwaukee, Wis.
- Master Electric Co., Dayton, O.
- McAlear Mfg. Co., Chicago, Ill.
- McCorkle Co., D. H., Berkeley, Calif.
- Mercoid Corp., Chicago, Ill.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
- Penn Electric Switch Co., Goshen, Ind.
- Perfex Corp. (Controls Div.), Milwaukee, Wis.
- Pioneer Heat Regulator Corp., Dayton, O.
- ●Powers Regulator Co., Chicago, Ill.
- Russell Electric Co., Chicago, Ill.
- ●Sarco Co., Inc., New York, N. Y.
- Sheer Co., H. M., Quincy, Ill.
- Spencer Thermostat Co., Attleboro, Mass.
- Standard Thermometer, Inc., Boston, Mass.
- Superstat Co., Springfield, Mass.
- Tallmadge & Co., Webster, East Orange, N. J.
- Thrush & Co., H. A., Peru, Ind.
- United Electric Controls Co., Boston, Mass.
- White Mfg. Co., St. Paul, Minn.

THERMOSTATS, SURFACE

- ●Barber-Colman Co., Rockford, Ill.
- ●Bristol Co., Waterbury, Conn.
- ●Detroit Lubricator Co., Detroit, Mich.
- Dunn, Inc., Struthers, Philadelphia, Pa.
- Edison, Inc., Thomas A., Edison Electric Controls Div., West Orange, N. J.
- Foxboro Co., Foxboro, Mass.
- ●Hart Mfg. Co., Hartford, Conn.
- Jefferson Electric Co., Bellwood, Ill.
- McCorkle Co., D. H., Berkeley, Cal.
- Mercoid Corp., Chicago, Ill.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
- Penn Electric Switch Co., Goshen, Ind.
- Perfex Corp. (Controls Div.), Milwaukee, Wis.
- ●Powers Regulator Co., Chicago, Ill.
- Ranco, Inc., Columbus, O.
- ●Sarco Co., Inc., New York, N. Y.
- Sheer Co., H. M., Quincy, Ill.
- Spencer Thermostat Co., Attleboro, Mass.
- Superstat Co., Springfield, Mass.
- Thrush & Co., H. A., Peru, Ind.
- United Electric Controls Co., Boston, Mass.

THERMOSTATS, TWO TEMPERATURE OR DUAL

- ●Barber-Colman Co., Rockford, Ill.
- ●Detroit Lubricator Co., Detroit, Mich.
- Friez & Sons, Inc., Julien P., Baltimore, Md.
- ●General Controls Co., San Francisco, Cal.
- H-B Instrument Co., Philadelphia, Pa.
- ●Illinois Engineering Co., Chicago, Ill.
- Jefferson Electric Co., Bellwood, Ill.
- ●Johnson Service Co., Milwaukee, Wis.
- McAlear Mfg. Co., Chicago, Ill.
- Mercoid Corp., Chicago, Ill.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
- Penn Electric Switch Co., Goshen, Ind.
- Perfex Corp. (Controls Div.), Milwaukee, Wis.
- Pioneer Heat Regulator Corp., Dayton, O.
- ●Powers Regulator Co., Chicago, Ill.
- Ranco, Inc., Columbus, O.
- ●Sarco Co., Inc., New York, N. Y.
- Sheer Co., H. M., Quincy, Ill.
- Superstat Co., Springfield, Mass.

THERMOSTATS, WEATHER COMPENSATING

- ●Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Foxboro Co., Foxboro, Mass.
- ●Johnson Service Co., Milwaukee, Wis.
- Leeds & Northrup Co., Philadelphia, Pa.
- ●Powers Regulator Co., Chicago, Ill.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- Taylor Instrument Companies, Rochester, N. Y.
- Thrush & Co., H. A., Peru, Ind.

TIME SWITCHES

See Switches, Time

TOGGLE BOLTS

See Bolts, Toggle and Anchor

TONGS, PIPE

- Armstrong Bros. Tool Co., Chicago, Ill.
- Billings & Spencer Co., Hartford, Conn.
- Jarecki Mfg. Co., Erie, Pa.
- Trimont Mfg. Co., Boston, Mass.
- ●Walworth Co., New York, N. Y.
- ●Williams & Co., J. H., New York, N. Y.

TORCHES, BRAZING

- Air Reduction Sales Co., New York, N. Y.
- Bastian-Blessing Co., Chicago, Ill.
- Bernz Co., Inc., Otto, Rochester, N. Y.
- Clayton & Lambert Mfg. Co., Detroit, Mich.
- Eclipse Fuel Engineering Co., Rockford, Ill.
- Gasweld & Airway, Inc., Chicago, Ill.
- Ideal Commutator Dresser Co., Sycamore, Ill.
- Imperial Brass Mfg. Co., Chicago, Ill.
- Insto-Gas Corp., Detroit, Mich.
- ●Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
- Milburn Co., Alexander, Baltimore, Md.
- Torchweld Equipment Co., Chicago, Ill.
- Turner Brass Wks., Sycamore, Ill.

TOWERS, COOLING, ATMOSPHERIC

- American Cooling Tower Co., Kansas City, Mo.
- ●Baker Ice Machine Co., Inc., Omaha, Nebr.
- ●Binks Mfg. Co., Chicago, Ill.
- Burhorn Co., Edwin, Hoboken, N. J.
- Cooling Tower Co., Inc., New York, N. Y.
- Fluor Corp., Los Angeles, Cal.
- Foster Wheeler Corp., New York, N. Y.
- Lilie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.
- ●Marley Co., Kansas City, Mo.
- Penn Cooling Tower Wks., Pittsburgh, Pa.
- Pennsylvania Engineering Wks., New Castle, Pa.
- Schubert-Christy Corp., Affton, St. Louis, Mo.
- Stewart Ice Machine Co., Los Angeles, Cal.
- Tippett & Wood, Phillipsburg, N. J.
- Water Cooling Tower Co., Chicago, Ill.
- Wheeler Mfg. Co., C. H., Philadelphia, Pa.

TOWERS, COOLING, MECHANICAL DRAFT

- Binks Mfg. Co., Chicago, Ill.
- Burhorn Co., Edwin, Hoboken, N. J.
- Cooling Tower Co., Inc., New York, N. Y.

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Foster Wheeler Corp., New York, N. Y.
Lilie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.
●Marley Co., Kansas City, Mo.
Penn Cooling Tower Wks., Pittsburgh, Pa.
Pennsylvania Engineering Wks., New Castle, Pa.
●Research Corp., New York, N. Y.
Schubert-Christy Corp., Affton, St. Louis, Mo.
Water Cooling Tower Co., Chicago, Ill.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.

TRANSMISSION DRIVES

See Drives, Chain, Flat Belt and V-Belt

TRAPS, STEAM, MECHANICAL

●American District Steam Co., North Tonawanda, N. Y.
●Anderson Co., V. D., Cleveland, O.
●Armstrong Machine Wks., Three Rivers, Mich.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Boylston Steam Specialty Co., Chicago, Ill.
Bundy Steam Trap Co., Nashua, N. H.
Burrows Mfg. Co., F. A., York, Pa.
Cashin Co., W. D., Boston, Mass.
Cochran Corp., Philadelphia, Pa.
Coe Mfg. Co., Painesville, O.
●Crane Co., Chicago, Ill.
Cryer Trap & Valve Co., Inc., New York, N. Y.
Davis Regulator Co., Chicago, Ill.
d'Este Co., Julian, Charlestown, Mass.
Ellis Drier Co., Chicago, Ill.
Fisher Governor Co., Marshalltown, Ia.
Haines & Co., William S., Philadelphia, Pa.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
Justus Steam Trap Co., Napanoch, N. Y.
Kaye & MacDonald, Inc., West Orange, N. J.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Lytton Mfg. Co., Franklin, Va.
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
McAuley Automatic Trap Co., Pittsburgh, Pa.
●Milwaukee Valve Co., Milwaukee, Wis.
Morehead Mfg. Co., Detroit, Mich.
Mueller Steam Specialty Co., Inc., New York, N. Y.
Nason Co., Detroit, Mich.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Reed Steam Equipment Co., Bridgeport, Conn.
●Sarco Co., Inc., New York, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Semans & Sons, Geo. G., Pittsburgh, Pa.
Squires Co., C. E., Cleveland, O.
Stay-Rite Co., Inc., Cleveland, O.
Sterling Engineering Co., Milwaukee, Wis.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Trerice Co., H. O., Detroit, Mich.
Vapor Heating Co., New York, N. Y.
Watson & McDaniel Co., Philadelphia, Pa.
●Webster & Co., Warren, Camden, N. J.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.
●Yarnall-Waring Co., Philadelphia, Pa.

TRAPS, STEAM, THERMOSTATIC

●American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit, Mich.
Cashin Co., W. D., Boston, Mass.
Cryer Trap & Valve Co., Inc., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
Haines & Co., William S., Philadelphia, Pa.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
●Milwaukee Valve Co., Milwaukee, Wis.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
●Powers Regulator Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Stay-Rite Co., Inc., Cleveland, O.
Sterling Engineering Co., Milwaukee, Wis.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Trane Co., La Crosse, Wis.
Vapor Heating Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

TUBE CLEANERS

See Cleaners, Tube

TUBES, BOILER

Bethlehem Steel Co., Bethlehem, Pa.
Globe Steel Tubes Co., Milwaukee, Wis.
International Engineering Wks., Inc., Framingham, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
●National Tube Co., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Reading Iron Co., Philadelphia, Pa.
●Republic Steel Corp., Cleveland, O.
Steel & Tubes, Inc., Cleveland, O.
Timken Steel & Tube Co., Canton, O.
U. S. Pipe Bending Co., San Francisco, Cal.
Youngstown Sheet & Tube Co., Youngstown, O.

TUBES, PITOT

Friez & Sons, Inc., Julien P., Baltimore, Md.
●Hill, E. Vernon, Chicago, Ill.

TUBING, ALLOY

Allegheny Steel Co., Brackenridge, Pa.
Alloy Steel Products Co., Linden, N. J. (Stainless steel)
Aluminum Co. of America, Pittsburgh, Pa. (Aluminum)
●American Brass Co., Waterbury, Conn.
Babcock & Wilcox Co., New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn. (Bronze and silicon bronze)
Carpenter Steel Co., Reading, Pa. (Stainless steel)
Colonial Stove Co., Specialties Div., Philadelphia, Pa.
Duraloy Co., Pittsburgh, Pa. (Stainless)
Globe Steel Tubes Co., Milwaukee, Wis.
International Nickel Co., New York, N. Y. (Monel)
●National Tube Co., Pittsburgh, Pa. (Stainless)
Phelps Dodge Copper Products Corp., British American Tube Div., New York, N. Y.
●Republic Steel Corp., Cleveland, O.
Revere Copper & Brass, Inc., New York, N. Y.
Scoville Mfg. Co., Waterbury, Conn. (Non-Ferrous)
Seamlex Co., Long Island City, N. Y. (Flexible, seamless)
Steel and Tubes, Inc., Cleveland, O. (Stainless steel)
Timken Steel & Tube Co., Canton, O. (Steel)
Wolverine Tube Co., Detroit, Mich. (Brass, Admiralty)

TUBING, COPPER

●American Brass Co., Waterbury, Conn.
American Radiator Co., New York, N. Y.
Baltimore Tube Co., Div. Revere Copper & Brass, Inc., Baltimore, Md.
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Phelps Dodge Copper Products Corp., British American Tube Div., New York, N. Y.
Revere Copper & Brass, Inc., New York, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Seamlex Co., Long Island City, N. Y. (Flexible seamless)
●Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
United States Brass & Copper Co., Hyde Park, Boston, Mass.
Winchester Repeating Arms Co., New Haven, Conn.

TUBING CUTTERS

See Cutters, Pipe and Tubing

TUBING, FINNED

●Bush Mfg. Co., Hartford, Conn.
●G. & O. Mfg. Co., New Haven, Conn.
Manufacturers Fin Coil Co., Chicago, Ill.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Refrigeration Appliances, Inc., Chicago, Ill.
●Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Standard Galvanizing Co., Chicago, Ill.
Trenton Auto Radiator Wks., Trenton, N. J.
Wolverine Tube Co., Detroit, Mich.

TUBING, STEEL

Babcock & Wilcox Co., New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Detroit Seamless Steel Tubes Co., Detroit, Mich.
Globe Steel Tubes Co., Milwaukee, Wis.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
●National Tube Co., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
●Republic Steel Corp., Cleveland, O.
Seamlex Co., Long Island City, N. Y. (Flexible, seamless)
South Chester Tube Co., Chester, Pa.
Spang-Chalfant, Inc., Pittsburgh, Pa.
Steel and Tubes, Inc., Cleveland, O.
Timken Steel & Tube Co., Canton, O.
Wheatland Tube Co., Philadelphia, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

TURBINES, MECHANICAL DRIVE

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Carling Blower Co., Worcester, Mass.
Coppus Engineering Corp., Worcester, Mass.
Dean Hill Pump Co., Anderson, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Elliott Co., Jeannette, Pa.

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●General Electric Co., Schenectady, N. Y.
Moore Steam Turbine Corp., Wellsville, N. Y.
Murray Iron Wks. Co., Burlington, Ia.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Terry Steam Turbine Co., Hartford, Conn.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Wing Mfg. Co., L. J., New York, N. Y.

2, 3 AND 4-WAY VALVES

See Valves, 2, 3 and 4-way

UNDERGROUND PIPING

See Conduit, Underground Piping

UNIONS, BRASS

Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
General Fittings Co. Providence, R. I.
Grabler Mfg. Co., Cleveland, O.
Hays Mfg. Co., Erie, Pa.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Mfg. Co., New York, N. Y.
King Union Co., Inc., Hillsgrove, R. I.
Lockport Fittings Co., Inc., Lockport, N. Y.
Lunkenheimer Co., Cincinnati, O.
●Milwaukee Valve Co., Milwaukee, Wis.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Standard Union Co., Lockport, N. Y.
●Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
●Walworth Co., New York, N. Y.
Weatherhead Co., Cleveland, O.

UNIONS, MALLEABLE, BRASS SEAT

Corley Co., Jersey City, N. J.
●Crane Co., Chicago, Ill.
●Dart Mfg. Co., E. M., Providence, R. I.
Detroit Brass & Malleable Wks., Detroit, Mich.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
●Fairbanks Co., New York, N. Y.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
General Fittings Co., Providence, R. I.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jefferson Union Co., Lexington, Mass.
Kennedy Valve Mfg. Co., Elmira, N. Y.
King Union Co., Inc., Hillsgrove, R. I.
Lockport Fittings Co., Inc., Lockport, N. Y.
●Malleable Iron Fittings Co., Branford, Conn.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Rockwood Sprinkler Co., Worcester, Mass.
Standard Union Co., Lockport, N. Y.
Star Mfg. Co., Inc., Providence, R. I.
Stockham Pipe & Fittings Co., Birmingham, Ala.
United Superior Union Co., Inc., Brooklyn, N. Y.
●Walworth Co., New York, N. Y.

UNIONS, STEEL

Alloy Steel Products Co., Linden, N. J. (Stainless steel).
Champion Machine & Forging Co., Cleveland, O.
●Crane Co., Chicago, Ill.
Rockwood Sprinkler Co. of Mass., Worcester, Mass.
Roessing Mfg. Co., Pittsburgh, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
●Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

UNIT AIR CONDITIONERS, COMFORT, COMPLETE

Airtemp, Inc., Detroit, Mich.
●American Blower Corp., Detroit, Mich.
American Car & Foundry Co., New York, N. Y.
Apex Rotarex Corp., Cleveland, O.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Betz Unit Air Cooler Co., Kansas City, Mo.
●Buffalo Forge Co., Buffalo, N. Y.
Builders Iron Foundry, Providence, R. I.
●Burnham Boiler Corp., Irvington, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carraway-Byrd Engineering Co., Dallas, Tex.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
De La Vergne Engine Co., Philadelphia, Pa.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●General Electric Co., Schenectady, N. Y.
General Refrigeration Corp., Beloit, Wis.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Howe Ice Machine Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
King Ventilating Co., Owatonna, Minn.
Kisco Co., Inc., St. Louis, Mo.
Manufacturers Fin Coil Co., Chicago, Ill.
Mayflower-Lewis Corp., St. Paul, Minn.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., Minneapolis, Minn.
Nelson Corp., Herman, Moline, Ill.
Niagara Blower Co., New York, N. Y.
Norge Heating & Conditioning Div., Borg-Warner Corp., Detroit, Mich.
Parks-Cramer Co., Fitchburg, Mass.
Peerless of America, Inc., Chicago, Ill.
Pamco Conditionaire Co., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
●Rempe Co., Chicago, Ill.
Somers, Inc., H. J., Detroit, Mich.
Standard Air Conditioning Inc., New York, N. Y.
Strandwitz & Co., Inc., Camden, N. J.
●Sturtevant Co., B. F., Boston, Mass.
Surface Combustion Corp., Toledo, O.
Thatcher Co., Newark, N. Y.
Thermal Units Mfg. Co., Meriden, Conn.
●Trane Co., La Crosse, Wis.
Unified Air Conditioner Co., Duluth, Minn.
●Unit Heater & Cooler Co., Wausau, Wis.
United States Radiator Corp., Detroit, Mich.
Viking Air Conditioning Corp., Cleveland, O.
●Westinghouse Electric & Mfg. Co., Mansfield, O.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
XL Refrigerating Co., Inc., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNIT AIR CONDITIONERS, INDUSTRIAL PROCESSING, COMPLETE

Air Devices Corp., Meriden, Conn.
Airtemp, Inc., Detroit, Mich.
●American Blower Corp., Detroit, Mich.
Anetsberger Bros., Chicago, Ill.
Apex Rotarex Corp., Cleveland, O.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Betz Unit Air Cooler Co., Kansas City, Mo.
●Buffalo Forge Co., Buffalo, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carraway-Byrd Engineering Co., Dallas, Tex.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
Economy Equipment Co., Inc., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
●General Electric Co., Schenectady, N. Y.
●Grinnell Co., Inc., Providence, R. I.
Howe Ice Machine Co., Chicago, Ill.
Kauffman Air Conditioning Corp.. St. Louis, Mo
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
King Ventilating Co., Owatonna, Minn.
Kisco Co., Inc., St. Louis, Mo.
Mayflower-Lewis Corp., St. Paul, Minn.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Murray Iron Wks. Co., Burlington, Ia.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
Niagara Blower Co., New York, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
●Rempe Co., Chicago, Ill.
●Research Corp., New York, N. Y.
Ross Engineering Corp., J. O., New York, N. Y.
Somers, Inc., H. J., Detroit, Mich.
Strandwitz & Co., Inc., Camden, N. J.
●Sturtevant Co., B. F., Boston, Mass.
Surface Combustion Corp.. Toledo, O.
Thermal Units Mfg. Co., Meriden, Conn.
●Trane Co., La Crosse, Wis.
Unified Air Conditioner Co., Duluth, Minn.
●Unit Heater & Cooler Co., Wausau, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
XL Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

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UNIT AIR CONDITIONERS, INDUSTRIAL PROCESSING, COOLING AND DEHUMIDIFYING

Advanced Refrigerating Systems Co., Philadelphia, Pa.
Airtemp, Inc., Detroit, Mich.
●American Blower Corp., Detroit, Mich.
Anetsberger Bros., Chicago, Ill.
Apex Rotarex Corp., Cleveland, O.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Betz Unit Air Cooler Co., Kansas City, Mo.
●Buffalo Forge Co., Buffalo, N. Y.
Builders Iron Foundry, Providence, R. I.
●Bush Mfg. Co., Hartford, Conn.
Campbell Heating Co., E. K., Kansas City, Mo.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carraway-Byrd Engineering Co., Dallas, Tex.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
Corozone Air Conditioning Corp., Cleveland, O.
De La Vergne Engine Co., Philadelphia, Pa.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
Economy Equipment Co., Inc., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●General Electric Co., Schenectady, N. Y.
General Refrigeration Corp., Beloit, Wis.
Giant Mfg. Co., Council Bluffs, Ia.
●Grinnell Co., Inc., Providence, R. I.
Howe Ice Machine Co., Chicago, Ill.
Humidi-Cooler Corp., West Haven, Conn.
Ilg Electric Ventilating Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
King Ventilating Co., Owatonna, Minn.
Manufacturers Fin Coil Co., Chicago, Ill.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Murray Iron Works, Burlington, Ia.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
Niagara Blower Co., New York, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Peerless of America, Inc., Chicago, Ill.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
Pittsburgh Lectrodryer Corp., Pittsburgh, Pa.
Refrigeration Appliances, Inc., Chicago, Ill.
Reliance Refrigerating Machine Co., Chicago, Ill.
●Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Ross Engineering Corp., J. O., New York, N. Y.
●Sturtevant Co., B. F., Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Thermal Units Mfg. Co., Meriden, Conn.
●Trane Co. La Crosse Wis.
Unified Air Conditioner Co., Duluth, Minn.
●Unit Heater & Cooler Co. Wausau, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
XL Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNIT AIR CONDITIONERS, INDUSTRIAL PROCESSING, HEATING AND HUMIDIFYING

Airtemp, Inc., Detroit, Mich.
●American Blower Corp., Detroit, Mich.
Anetsberger Bros., Chicago, Ill.
Bahnson Co., Winston-Salem, N. C.
Betz Unit Air Cooler Co., Kansas City, Mo.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., E. K., Kansas City, Mo.
Carraway-Byrd Engineering Co., Dallas, Tex.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
Corozone Air Conditioning Corp., Cleveland, O.
Economy Equipment Co., Inc., Chicago, Ill.
●Grinnell Co., Inc., Providence, R. I.
International Moistening Co., Providence, R. I.
Kauffman Air Conditioning Corp., St. Louis, Mo.
King Ventilating Co., Owatonna, Minn.
Manufacturers Fin Coil Co., Chicago, Ill.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
Niagara Blower Co., New York, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Pfening Co., Fred D., Columbus, O.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
Ross Engineering Corp., J. O., New York, N. Y.
Somers, Inc., H. J., Detroit, Mich.
Surface Combustion Co., Racine, Wis.
●Sturtevant Co., B. F., Boston, Mass.
Thermal Units Mfg. Co., Meriden, Conn.
●Trane Co., La Crosse, Wis.
Unified Air Conditioner Co., Duluth, Minn.
●Unit Heater & Cooler Co., Wausau, Wis.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNIT AIR COOLERS, COMFORT, COOLING AND DEHUMIDIFYING

Advanced Refrigerating Systems Co., Philadelphia, Pa.
Air Devices Corp., Meriden, Conn.
Airgard Mfg. Co., Chicago, Ill.
Airtemp, Inc., Detroit, Mich.
●American Blower Corp., Detroit, Mich.
American Car & Foundry Co., New York, N. Y.
Anetsberger Bros., Chicago, Ill.
Apex Rotarex Corp., Cleveland, O.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Ballantyne Co., Omaha, Nebr.
Betz Unit Air Cooler Co., Kansas City, Mo.
●Buffalo Forge Co., Buffalo, N. Y.
Builders Iron Foundry Co., Providence, R. I.
●Bush Mfg. Co., Hartford, Conn.
Campbell Heating Co., E. K., Kansas City, Mo.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carraway-Byrd Engineering Co., Dallas, Tex.
Carrier Corp., Syracuse, N. Y.
Chicago Pump Co., Chicago, Ill.
●Clarage Fan Co., Kalamazoo, Mich.
Clark Equipment Co., Buchanan, Mich.
Climax Machinery Co., Indianapolis, Ind.
Conditionaire Unit Co., Chicago, Ill.
Crystal Refrigerator Co., Fremont, Neb.
De La Vergne Engine Co., Philadelphia, Pa.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
Fairbanks, Morse & Co., Chicago, Ill.
●Fedders Mfg. Co., Buffalo, N. Y.
General Air Conditioning Corp., Cincinnati, O.
●General Electric Co., Schenectady, N. Y.
General Refrigeration Corp., Beloit, Wis.
●Grinnell Co., Inc., Providence, R. I.
Hardy Mfg. Co., Inc., Dayton, O.
Howe Ice Machine Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Indian Trailer Corp., Koolroom Div., Chicago, Ill.
●Johnson Fan & Blower Corp., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
King Ventilating Co., Owatonna, Minn.
Kisco Co., Inc., St. Louis, Mo.
Larkin Refrigerating Corp., Atlanta, Ga.
Manufacturers Fin Coil Co., Chicago, Ill.
Marlo Coil Co., St. Louis, Mo.
Mayflower-Lewis Corp., St. Paul, Minn.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., Minneapolis, Minn.
Nelson Corp., Herman, Moline, Ill.
Niagara Blower Co., New York, N. Y.
Norge Heating & Conditioning Div., Borg-Warner Corp., Detroit, Mich.
Pamco Conditionaire Co., Chicago, Ill.
Peerless of America, Inc., Chicago, Ill.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
Pleasantaire Corp., Washington, D. C.
Polar Air, Inc., Dallas, Texas.
Refrigeration Appliances, Inc., Chicago, Ill.
Reliance Refrigerating Machine Co., Chicago, Ill.
●Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Servel, Inc., Evansville, Ind.
Standard Air Conditioning, Inc., New York, N. Y.
Thermal Units Mfg. Co., Meriden, Conn.
●Trane Co., La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Unified Air Conditioner Co., Duluth, Minn.
●Unit Heater & Cooler Co., Wausau, Wis.
●Westinghouse Electric & Mfg. Co., Mansfield, O.
Willard Metallic Crypt Co., Willard, O.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
XL Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNIT AIR HUMIDIFIERS, COMFORT, HEATING AND HUMIDIFYING

Airgard Mfg. Co., Chicago, Ill.
Airtemp, Inc., Detroit, Mich.
●American Blower Corp., Detroit, Mich.
Betz Unit Air Cooler Co., Kansas City, Mo.
Bryant Heater Co., Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
●Burnham Boiler Corp., Irvington, N. Y.

●Advertisement in this issue. See Index to Advertisers, page 232.

Campbell Heating Co., Des Moines, Ia.
Campbell Heating Co., E. K., Kansas City, Mo.
Carraway-Byrd Engineering Co., Dallas, Tex.
●Clarage Fan Co., Kalamazoo, Mich.
Continental Motors Corp., Detroit, Mich.
●General Electric Co., Schenectady, N. Y.
●Grinnell Co., Inc., Providence, R. I.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Ilg Electric Ventilating Co., Chicago, Ill.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Moistening Co., Providence, R. I.
Kauffman Air Conditioning Corp., St. Louis, Mo.
King Ventilating Co., Owatonna, Minn.
Maid-O-Mist, Inc., Chicago, Ill.
Manufacturers Fin Coil Co., Chicago, Ill.
Mayflower-Lewis Corp., St. Paul, Minn.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Montag Stove & Furnace Wks., Portland, Ore.
Mountain States Equipment Co., Denver, Colo.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., Minneapolis, Minn.
Nelson Corp., Herman, Moline, Ill.
Niagara Blower Co., New York, N. Y.
Norge Heating & Conditioning Div., Borg-Warner Corp., Detroit, Mich.
Parks-Cramer Co., Fitchburg, Mass.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
Schwitzer-Cummins Co., Indianapolis, Ind.
Smith Co., H. B., Westfield, Mass.
Somers, Inc., H. J., Detroit, Mich.
Standard Air Conditioning, Inc., New York, N. Y.
Standard Engineering Wks., Pawtucket, R. I.
Surface Combustion Corp., Toledo, O.
Thermal Units Mfg. Co., Meriden, Conn.
●Trane Co., La Crosse, Wis.
Unified Air Conditioner Co., Duluth, Minn.
●Unit Heater & Cooler Co., Wausau, Wis.
U. S. Air Conditioning Corp., Minneapolis, Minn.
Utica Radiator Corp., Utica, N. Y.
Western Blower Co., Seattle, Wash.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNIT HEATERS

See Heaters, Unit

UNIT VENTILATORS

See Ventilators, Unit

UNITS, WINDOW VENTILATOR AND FILTER

Airgard Mfg. Co., Chicago, Ill.
Amirton Co., New York, N. Y.
Berns Specialty Co., Chicago, Ill.
Burrowes Corp., Portland, Me.
Coppus Engineering Corp., Worcester, Mass.
Davies Air Filter Co., New York, N. Y.
Falstrom Co., Passaic, N. J.
Kaiser Co., H. S., Chicago, Ill.
Kisco Co., Inc., St. Louis, Mo.
Mellish & Murray Co., Chicago, Ill.
National Laboratories, Inc., Boston, Mass.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Reed Unit-Fans, Inc., New Orleans, La.
Schwitzer-Cummins Co., Indianapolis, Ind.
Somers, Inc., H. J., Detroit, Mich.
Standard Air Conditioning, Inc., New York, N. Y.
●Staynew Filter Corp., Rochester, N. Y.
Truscon Steel Co., Youngstown, O.
Unified Air Conditioner Co., Duluth, Minn.
Utility Fan Corp., Los Angeles, Cal.
●Young Radiator Co., Racine, Wis.

VACUUM GAGES

See Gages, Vacuum

VACUUM HEATING SYSTEMS

See Systems, Heating, Vacuum

VACUUM PUMPS

See Pumps, Vacuum

VACUUM RECORDERS

See Recorders, Vacuum

VALVE OPERATORS

See Operators, Valve

VALVES, ANGLE

●American Brass Co., Waterbury, Conn.
American Radiator Co., New York, N. Y.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit, Mich.
Central Brass Mfg. Co., Cleveland, O.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Gorton Heating Corp., Cranford, N. J.
●Grinnell Co., Inc., Providence, R. I.
Hasco Valve & Machine Co., Milwaukee, Wis.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
●Milwaukee Valve Co., Milwaukee, Wis.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth. O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Pittsburgh Valve Foundry & Construction Co., Pittsburgh, Pa
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Star Brass Mfg. Co., Boston, Mass.
Strong, Carlisle & Hammond Co., Cleveland, O.
●Walworth Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, BLOW-OFF

American Radiator Co., New York, N. Y.
Babcock & Wilcox Co., New York, N. Y.
Barrett Machine Co., N. S. Pittsburgh. Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Elliott Co., Jeannette, Pa.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Bros., New York, N. Y.
Keckley Co., O. C., Chicago, Ill.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
Merco Nordstrom Valve Co., Pittsburgh, Pa.
Ohio Injector Co., Wadsworth, O.
Pittsburgh Valve Fdry. & Construction Co., Pittsburgh. Pa
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc. Bridgeport, Conn.
Schutte & Koerting Co., Philadelphia, Pa.
Strong, Carlisle & Hammond Co., Cleveland, O.
●Walworth Co., New York, N. Y.
●Yarnall-Waring Co., Philadelphia, Pa.

VALVES, CHECK

American Hard Rubber Co., New York, N. Y. (Hard rubber)
American Radiator Co., New York, N. Y.
Barrett, Haentjens & Co., Hazelton, Pa.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit Mich.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
Eclipse Fuel Engineering Co., Rockford, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Fairbanks Co., New York, N. Y.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Foster Engineering Co., Newark, N. J.
●Grinnell Co., Inc., Providence, R. I.
Hasco Valve & Machine Co., Milwaukee, Wis.
Hoosick Engineering Co., Inc., Hoosick Falls, N. Y.
Illinois Malleable Iron Co. Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co. Elmira, N. Y.
Locke Regulator Co., Salem, Mass.
Lonergan Co., J. E., Philadelphia, Pa. (Hydraulic)
Ludlow Valve Mfg. Co., Troy, N. Y.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
●Milwaukee Valve Co., Milwaukee, Wis.
Mueller Co., Decatur, Ill.
Ohio Brass Co., Mansfield O.

●Advertisement in this issue. See Index to Advertisers, page 282.

Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Ruggles-Klingemann Mfg. Co., Salem, Mass. (Bleeder type)
Schutte & Koerting Co., Philadelphia, Pa.
Smolensky Valve Co., Inc., Cleveland, O.
Star Brass Mfg. Co., Boston, Mass.
Strong, Carlisle & Hammond Co., Cleveland, O.
●Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.
Williams Gauge Co., Pittsburgh, Pa. (Noiseless)

VALVES, DIAPHRAGM

American Radiator Co., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Belfield Co., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
●Bristol Co., Waterbury, Conn.
Cash Co., A. W., Decatur, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
Eclipse Fuel Engineering Co., Rockford, Ill.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
●General Controls Co., San Francisco, Cal., and Cleveland, O.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Kieley & Mueller Co., Inc., New York, N. Y.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
●Milwaukee Valve Co., Milwaukee, Wis.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Northern Indiana Brass Co., Elkhart, Ind.
Parks-Cramer Co., Fitchburg, Mass.
Powell Co., Wm., Cincinnati, O.
●Powers Regulator Co., Chicago, Ill.
Reed Steam Equipment Co., Bridgeport, Conn.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.
●Trane Co., La Crosse, Wis.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

VALVES, FLOAT

American Radiator Co., New York, N. Y.
Atlas Valve Co., Inc., Newark, N. J.
●Automatic Products Co., Milwaukee, Wis. (Oil)
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Chase Brass & Copper Co., Waterbury, Conn.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
Eclipse Fuel Engineering Co., Rocklord, Ill.
Eddy Valve Co., Waterford, N. Y.
Foster Engineering Co., Newark, N. J.
Hasco Valve & Machine Co., Milwaukee, Wis.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Locke Regulator Co., Salem, Mass.
Ludlow Valve Mfg. Co., Troy, N. Y.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
Reed Steam Equipment Co., Bridgeport, Conn.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schaphorst, W. F., Newark, N. J.
Schutte & Koerting Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Swartwout Co., Cleveland, O.
●Trane Co., La Crosse, Wis.
Watts Regulator Co., Lawrence, Mass.

VALVES, FORGED STEEL

Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Henry Valve Co., Chicago, Ill.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
Merco Nordstrom Valve Co., Pittsburg, Pa.
Vogt Machine Co., Henry, Louisville, Ky.

VALVES, GATE, BRASS AND BRONZE

●American Brass Co., Waterbury, Conn.
American Injector Co., Detroit, Mich.
Belknap Mfg. Co., Bridgeport, Conn.
Bordo Co., Inc., L. J., Glenside, Pa.
Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit, Mich.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
Eddy Valve Co., Waterford, N. Y.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Gorton Heating Corp., Cranford, N. J.
Hammond Brass Wks., Hammond, Inc.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
●Milwaukee Valve Co., Milwaukee, Wis.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Scott Valve Mfg. Co., Detroit, Mich.
Star Brass Mfg. Co., Boston, Mass.
●Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GATE, IRON BODY

American Radiator Co., New York, N. Y.
Bordo Co., Inc., L. J., Glenside, Pa.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford, N. Y.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Hasco Valve & Machine Co., Milwaukee, Wis.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Ohio Injector Co., Wadsworth, O.
Pittsburgh Valve & Fittings Co., Barberton, O.
Pittsburgh Valve Foundry & Construction Corp., Pittsburgh, Pa.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Rensaeller Valve Co., Cohoes, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Scott Valve Mfg. Co., Detroit, Mich.
Semet-Solvay Engineering Corp., New York, N. Y.
●Walworth Co., New York, N. Y.
Willams Valve Co., D. T., Cincinnati, O.

VALVES, GATE, STEEL

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
Bordo Co., Inc., L. J., Glenside, Pa.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Everlasting Valve Co., Jersey City, N. J.
Hasco Valve & Machine Co., Milwaukee, Wis.
Jenkins Bros., New York, N. Y.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Valve Fdry. & Construction Co., Pittsburgh, Pa.
Powell Co., Wm., Cincinnati, O.

●Advertisement in this issue. See Index to Advertisers, page 232.

- ●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
- Schutte & Koerting Co., Philadelphia, Pa.
- ●Walworth Co., New York, N. Y.
- Williams Valve Co., D. T., Cincinnati, O.
- ●Worthington Pump & Machinery Corp., Harrison, N. J.

VALVES, GLOBE, BRASS AND BRONZE

- ●American Brass Co., Waterbury, Conn.
- American Injector Co., Detroit, Mich.
- Belfield Co., H., Philadelphia, Pa.
- Belknap Mfg. Co., Bridgeport, Conn.
- Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit, Mich.
- Central Brass Mfg. Co., Cleveland, O.
- Chapman Valve Mfg. Co., Indian Orchard, Mass.
- Chase Brass & Copper Co., Waterbury, Conn.
- ●Crane Co., Chicago, Ill.
- Detroit Brass & Malleable Wks., Detroit, Mich.
- ●Detroit Lubricator Co., Detroit, Mich.
- ●Fairbanks Co., New York, N. Y.
- Flagg Co., Inc., Stanley G., Philadelphia, Pa.
- ●Grinnell Co., Inc., Providence, R. I.
- Hammond Brass Wks., Hammond, Ind.
- Jarecki Mfg. Co., Erie, Pa.
- Jenkins Bros., New York, N. Y.
- Kennedy Valve Mfg. Co., Elmira, N. Y.
- Klingerit, Inc., New York, N. Y.
- Lunkenheimer Co., Cincinnati, O.
- Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
- ●Milwaukee Valve Co., Milwaukee, Wis.
- National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
- Northern Indiana Brass Co., Elkhart, Ind.
- Ohio Brass Co., Mansfield, O.
- Ohio Injector Co., Wadsworth, O.
- Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
- Pittsburgh Valve & Fittings Corp., Barberton, O.
- Powell Co., Wm., Cincinnati, O.
- ●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
- Star Brass Mfg. Co., Boston, Mass.
- Strong, Carlisle & Hammond Co., Cleveland, O.
- ●Walworth Co., New York, N. Y.
- ●Watson-Stillman Co., Roselle, N. Y.
- Williams Valve Co., D. T., Cincinnati, O.

VALVES, GLOBE, IRON BODY

- American Radiator Co., New York, N. Y.
- Belfield Co., H., Philadelphia, Pa.
- Chapman Valve Mfg. Co., Indian Orchard, Mass.
- ●Crane Co., Chicago, Ill.
- Edward Valve & Mfg. Co., East Chicago, Ind.
- ●Fairbanks Co., New York, N. Y.
- Jarecki Mfg. Co., Erie, Pa.
- Jenkins Bros., New York, N. Y.
- Kennedy Valve Mfg. Co., Elmira, N. Y.
- Klingerit, Inc., New York, N. Y.
- Lunkenheimer Co., Cincinnati, O.
- McAlear Mfg. Co., Chicago, Ill.
- National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
- Ohio Injector Co., Wadsworth, O.
- Pittsburgh Valve & Fittings Corp., Barberton, O.
- Powell Co., Wm., Cincinnati, O.
- ●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
- Star Brass Mfg. Co., Boston, Mass.
- Strong, Carlisle & Hammond Co., Cleveland, O.
- ●Walworth Co., New York, N. Y.
- Williams Valve Co., D. T., Cincinnati, O.

VALVES, GLOBE, STEEL

- Alloy Steel Products Co., Linden, N. J. (Stainless steel)
- Belfield Co., H., Philadelphia, Pa.
- Chapman Valve Mfg. Co., Indian Orchard, Mass.
- ●Crane Co., Chicago, Ill.
- Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
- Hasco Valve & Machine Co., Milwaukee, Wis.
- Jarecki Mfg. Co., Erie, Pa.
- Jenkins Bros., New York, N. Y.
- Klingerit, Inc., New York, N. Y.
- Lunkenheimer Co., Cincinnati, O.
- Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
- McAlear Mfg. Co., Chicago, Ill.
- National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
- Powell Co., Wm., Cincinnati, O.
- ●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
- Star Brass Mfg. Co., Boston, Mass.
- Strong, Carlisle & Hammond Co., Cleveland, O.
- ●Walworth Co., New York, N. Y.
- Williams Valve Co., D. T., Cincinnati, O.

VALVES, LINED

- American Hard Rubber Co., New York, N. Y. (Hard rubber lined)
- Bordo Co., Inc., L. J., Glenside, Pa. (Lead, copper, tin, etc.)
- Goodrich Co., B. F., Akron, O. (Rubber lined)
- Jenkins Bros., New York, N. Y. (tin)
- Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead or tin)
- National Lead Co., New York, N. Y.
- Northern Indiana Brass. Co., Elkhart, Ind. (Tinned)
- Pfaudler Co., Rochester, N. Y. (Glass lined)
- Resisto Pipe & Valve Co., East Cambridge, Mass. (Lead)

VALVES, MIXING, STEAM AND WATER

- Boiler Room Equipment, Inc., New York, N. Y.
- ●Fulton Sylphon Co., Knoxville, Tenn.
- ●Johnson Service Co., Milwaukee, Wis.
- Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
- National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
- ●Powers Regulator Co., Chicago, Ill.
- ●Sarco Co., Inc., New York, N. Y.
- Schutte & Koerting Co., Philadelphia, Pa.
- Sterling Engineering Co., Milwaukee, Wis.

VALVES, MOTOR OPERATED

- Automatic Temperature Control Co., Inc., Philadelphia, Pa.
- ●Barber-Colman Co., Rockford, Ill.
- ●Bristol Co., Waterbury, Conn.
- Chapman Valve Mfg. Co., Indian Orchard, Mass.
- Cooper Co., Clark, Philadelphia, Pa.
- ●Crane Co., Chicago, Ill.
- Cutler-Hammer, Inc., Milwaukee, Wis.
- Darling Valve & Mfg. Co., Williamsport, Pa.
- Davis Regulator Co., Chicago, Ill.
- ●Detroit Lubricator Co., Detroit, Mich.
- Eddy Valve Co., Waterford, N. Y.
- Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
- ●Fairbanks Co., New York, N. Y.
- Foster Engineering Co., Newark, N. J.
- Foxboro Co., Foxboro, Mass.
- Friez & Sons, Inc., Julien P., Baltimore, Md.
- ●General Controls Co., San Francisco, Cal., and Cleveland, O.
- ●General Electric Co., Schenectady, N. Y.
- Hasco Valve & Machine Co., Milwaukee, Wis.
- ●Illinois Engineering Co., Chicago, Ill.
- Jenkins Bros., New York, N. Y.
- Kennedy Valve Mfg. Co., Elmira, N. Y.
- Kieley & Mueller, Inc., New York, N. Y.
- Ludlow Valve Mfg. Co., Troy, N. Y.
- Lunkenheimer Co., Cincinnati, O.
- Mason-Neilan Regulator Co., Boston, Mass.
- McAlear Mfg. Co., Chicago, Ill.
- Mercoid Corp., Chicago, Ill.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
- Powell Co., Wm., Cincinnati, O.
- ●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
- Ruggles-Klingemann Mfg. Co., Salem, Mass.
- ●Sarco Co., Inc., New York, N. Y.
- Schutte & Koerting Co., Philadelphia, Pa.
- Shallcross Controls, Inc., Milwaukee, Wis.
- Sterling Engineering Co., Milwaukee, Wis.
- Tallmadge & Co., Webster, East Orange, N. J.
- Taylor Instrument Companies, Rochester, N. Y.
- Vogt Machine Co., Henry, Louisville, Ky.
- ●Walworth Co., New York, N. Y.

VALVES, NEEDLE

- Central Brass Mfg. Co., Cleveland, O.
- Chapman Valve Mfg. Co., Indian Orchard, Mass.
- ●Crane Co., Chicago, Ill.
- Detroit Brass & Malleable Wks., Detroit, Mich.
- ●Detroit Lubricator Co., Detroit, Mich.
- Edward Valve & Mfg. Co., East Chicago, Ind.
- Jarecki Mfg. Co., Erie, Pa.
- Jenkins Bros., New York, N. Y.
- Kennedy Valve Mfg. Co., Elmira, N. Y.
- Lunkenheimer Co., Cincinnati, O.
- Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
- ●Milwaukee Valve Co., Milwaukee, Wis.
- Ohio Injector Co., Wadsworth, O.
- Powell Co., Wm., Cincinnati, O.
- ●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
- ●Walworth Co., New York, N. Y.

VALVES, PLUG

- Barrett, Haentjens & Co., Hazelton, Pa.
- Barrett Machine Co., N. S., Pittsburgh, Pa.
- Bordo Co., Inc., L. J., Glenside, Pa.
- Chapman Valve Mfg. Co. Indian Orchard, Mass.
- ●Crane Co., Chicago, Ill.
- Eddy Valve Co., Waterford, N. Y.
- ●Fairbanks Co., New York, N. Y.

●Advertisement in this issue. See Index to Advertisers, page 232.

Hasco Valve & Machine Co., Milwaukee, Wis.
●Henry Valve Co., Chicago, Ill.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Jenkins Bros., New York, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Merco Nordstrom Valve Co., Pittsburgh, Pa. (Lubricated)
Mueller Co., Decatur, Ill.
Ohio Injector Co., Wadsworth, O.
Pittsburgh Brass Mfg. Co., Pittsburgh, Pa.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
●Walworth Co., New York, N. Y.

VALVES, PRESSURE REDUCING AND REGULATING

●American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Atlas Valve Co., Inc., Newark, N. J.
Bailey Meter Co., Cleveland, O.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Belfield Co., H., Philadelphia, Pa.
●Bell & Gossett Co., Chicago, Ill.
Boylston Steam Specialty Co., Chicago, Ill.
Cash Co., A. W., Decatur, Ill.
Central Brass Mfg. Co., Pittsburgh, Pa.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
●Dunham Co., C. A., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
●Fulton Sylphon Co., Knoxville, Tenn.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Hoosick Engineering Co., Inc., Hoosick Falls, N. Y.
●Illinois Engineering Co., Chicago, Ill.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Norgren Co., Inc., C. A., Denver, Colo.
●Powers Regulator Co. Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Spence Engineering Co., Inc., Walden, N. Y.
Squires Co., C. E., Cleveland, O.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.
Trerice Co., H. O., Detroit, Mich.
Tryco Products, Inc., Westfield, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.

VALVES, RADIATOR, AIR

Anderson Products Inc., Cambridge, Mass.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Beaton & Corbin Mfg. Co., Southington, Conn.
●Burnham Boiler Corp., Irvington, N. Y.
Chicago Specialty Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Dole Valve Co., Chicago, Ill.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Jarecki Mfg. Co., Erie, Pa.
Keeney Mfg. Co., Newington, Conn.
Little Mfg. Co., M. S., Hartford, Conn.
Maid-O-Mist, Inc., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Murdock Mfg. & Supply Co., Cincinnati, O.
National Metal Products Corp., Chicago, Ill.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
New York Air Valve Corp., New York, N. Y.
Russell & Co., W. A., New York, N. Y.
Slater Mfg. Co., Wakefield, Mass.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, ELECTRIC

●Barber-Colman Co., Rockford, Ill.
Electric Valve Mfg. Co., Inc., New York, N. Y.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Sarco Co., Inc., New York, N. Y.
Taylor Instrument Companies, Rochester, N. Y.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, PNEUMATIC

●Johnson Service Co., Milwaukee, Wis.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
●Powers Regulator Co., Chicago, Ill.
Taylor Instrument Companies, Rochester, N. Y.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, SELF-CONTAINED

●Fulton Sylphon Co., Knoxville, Tenn.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Powers Regulator Co., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Tallmadge & Co., Webster, East Orange, N. J.
Taylor Instrument Companies, Rochester, N. Y.
●Trane Co., La Crosse, Wis.
●Webster & Co., Warren, Camden, N. J.

VALVES, RADIATOR, STEAM AND HOT WATER

American Radiator Co., New York, N. Y.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
●Burnham Boiler Corp., Irvington, N. Y.
Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit, Mich.
Commonwealth Brass Corp., Detroit, Mich.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
●Fairbanks Co., New York, N. Y.
●Fulton Sylphon Co., Knoxville, Tenn.
Gorton Heating Corp., Cranford, N. J.
●Grinnell Co., Inc., Providence, R. I.
Haines & Co., William S., Philadelphia, Pa.
Hammond Brass Wks., Hammond, Ind.
●Hoffman Specialty Co., Waterbury, Conn.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Bros., New York, N. Y
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
Maid-O-Mist, Inc., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
●Milwaukee Valve Co., Milwaukee, Wis.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Fdry. Co., Eureka Valve Div., Cincinnati, O.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Powell Co., Wm., Cincinnati, O.
●Powers Regulator Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
●Trane Co., La Crosse, Wis.
●Walworth Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

VALVES, RADIATOR, STEAM AND HOT WATER, MODULATING

●American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Barnes & Jones, Inc., Boston, Mass.
Belknap Mfg. Co., Bridgeport, Conn.
Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit, Mich.
Cashin Co., W. D., Boston, Mass.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Cryer Trap & Valve Co., Inc., New York, N. Y.
●Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
●Fulton Sylphon Co., Knoxville, Tenn.
Gorton Heating Corp., Cranford, N. J.
Haines & Co., William S., Philadelphia, Pa.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Illinois Engineering Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
McAlear Mfg. Co., Chicago, Ill.
●Milwaukee Valve Co., Milwaukee, Wis.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.

●Advertisement in this issue. See Index to Advertisers, page 232.

Ohio Brass Co., Mansfield, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
●Sarco Co., Inc., New York, N. Y.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Stay-Rite Co., Inc., Cleveland, O.
Sterling Engineering Co., Milwaukee, Wis.
Tallmadge & Co., Webster, East Orange, N. J.
●Trane Co., La Crosse, Wis.
Vapor Heating Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

VALVES, REFRIGERATION (ANGLE, CHECK, GATE, GLOBE, NEEDLE, RELIEF)

●Crane Co., Chicago, Ill.
●Electrimatic Corp., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
●Henry Valve Co., Chicago, Ill.
Kerotest Mfg. Co., Pittsburgh, Pa.
Peerless of America, Inc., Chicago, Ill.
Perfection Refrigeration Parts Co., Harvey, Ill.
Triumph Ice Machine Co., Cincinnati, O.
●Vilter Mfg. Co., Milwaukee, Wis.
Voss, Inc., J. H. H., New York, N. Y.
XL Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, EXPANSION, CONSTANT PRESSURE

●Alco Valve Co., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Automatic Products Co., Milwaukee, Wis.
Cash Co., A. W., Decatur, Ill.
●Detroit Lubricator Co., Detroit, Mich.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Foster Engineering Co., Newark, N. J.
●Frick Co., Waynesboro, Pa.
Kerotest Mfg. Co., Pittsburgh, Pa.
Mercoid Corp., Chicago, Ill.
Peerless of America, Inc., Chicago, Ill.
Perfection Refrigeration Parts Co., Harvey, Ill.
Taylor Instrument Companies, Rochester, N. Y.
Triumph Ice Machine Co., Cincinnati, O.
Vogt Machine Co., Henry, Louisville, Ky.
X L Refrigerating Co., Chicago, Ill.

VALVES, REFRIGERATION, EXPANSION, THERMOSTATIC

●Alco Valve Co., Inc., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Automatic Products Co., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Mayson Mfg. Co., Inc., Detroit, Mich.
Mercoid Corp., Chicago, Ill.
Peerless of America, Inc., Chicago, Ill.
Perfection Refrigeration Parts Co., Harvey, Ill.
Spoehrer-Lange Co., St. Louis, Mo.
Sterling Engineering Co., Milwaukee, Wis.
Taylor Instrument Companies, Rochester, N. Y.
Torrey Refrigeration Products, Los Angeles, Cal.
Voss Co., J. H. H., New York, N. Y.
X L Refrigerating Co., Chicago, Ill.

VALVES, REFRIGERATION, FLOAT, HIGH PRESSURE

●Alco Valve Co., Inc., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Automatic Products Co., Milwaukee, Wis.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●Frick Co., Waynesboro, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Perfection Refrigeration Parts Co., Harvey, Ill.
Strong, Carlisle & Hammond Co., Cleveland, O.
Taylor Instrument Companies, Rochester, N. Y.
●Vilter Mfg. Co., Milwaukee, Wis.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, MAGNETIC STOP

●Alco Valve Co., Inc., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Automatic Products Co., Milwaukee, Wis.
Automatic Switch Co., New York, N. Y.
Cooper Co., Clark, Philadelphia, Pa.
●Detroit Lubricator Co., Detroit, Mich.
Electric Valve Mfg. Co., Inc., New York, N. Y.
Electrimatic Corp., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
●General Controls Co., San Francisco, Cal.
Mercoid Corp., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
X L Refrigerating Co., Chicago, Ill.

VALVES, REFRIGERATION, WATER REGULATING, PRESSURE OR TEMPERATURE ACTUATED

Electrimatic Corp., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Perfection Refrigeration Parts Co., Harvey, Ill.
Shank, Cyrus, Chicago, Ill.

VALVES, RELIEF

Ashton Valve Co., Cambridge, Mass.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Boylston Steam Specialty Co., Chicago, Ill.
Cash Co., A. W., Decatur, Ill.
Central Brass Mfg. Co., Cleveland, O.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Foster Engineering Co., Newark, N. J.
●Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Locke Regulator Co., Salem, Mass.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
●Milwaukee Valve Co., Milwaukee, Wis.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
Penberthy Injector Co., Detroit, Mich.
Powell Co., Wm., Cincinnati, O.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Spencer Thermostat Co., Attleboro, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Star Brass Mfg. Co., Boston, Mass.
Sterling Engineering Co., Milwaukee, Wis.
Swartwout Co., Cleveland, O.
Thrush & Co., H. A., Peru, Ind.
Tryco Products, Inc., Westfield, Mass.
●Watson-Stillman Co., Roselle, N. J.
Watts Regulator Co., Lawrence, Mass.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.

VALVES, SOLDER JOINT

●American Brass Co., Waterbury, Conn.
Bordo Co., Inc., L. J., Glenside, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Jenkins Bros., New York, N. Y.
Northern Indiana Brass Co., Elkhart, Ind.
Powell Co., Wm., Cincinnati, O.
●Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
●Walworth Co., New York, N. Y. (Brazed)

VALVES, SOLENOID

●Alco Valve Co., Inc., St. Louis, Mo.
Anderson Products, Inc., Cambridge, Mass.
●Automatic Products Co., Milwaukee, Wis.
Automatic Switch Co., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Belfield Co., H., Philadelphia, Pa.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
Davis Regulator Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Electric Valve Mfg. Co., Inc., New York, N. Y.
Electrimatic Corp., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
●Frick Co., Waynesboro, Pa.
Friez & Sons, Inc., Julien P., Baltimore, Md.
●General Controls Co., San Francisco, Cal.
●General Electric Co., Schenectady, N. Y.
Keckley Co., O. C., Chicago, Ill.
McCorkle Co., D. H., Berkeley, Cal.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monmouth Products Co., Cleveland, O.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Northern Indiana Brass Co., Elkhart, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pfening Co., Fred D., Columbus, O.
R-S Products Corp., Philadelphia, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schutte & Koerting Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
●Sarco Co., Inc., New York, N. Y.
Supreme Electric Products Corp., Rochester, N. Y.

VALVES, 2, 3, AND 4 WAY

●Barber-Colman Co., Rockford, Ill.
Belfield Co., H., Philadelphia, Pa.
Bordo Co., Inc., Glenside, Pa.
Cash Co., A. W., Decatur, Ill.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
●General Controls Co., San Francisco, Cal.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Jarecki Mfg. Co., Erie, Pa.

●Advertisement in this issue. See Index to Advertisers, page 332.

- ●Johnson Service Co., Milwaukee, Wis.
- Lunkenheimer Co., Cincinnati, O.
- Merco Nordstrom Valve Co., Pittsburgh, Pa.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
- Penn Electric Switch Co., Goshen, Ind.
- Powell Co., Wm., Cincinnati, O.
- ●Powers Regulator Co., Chicago, Ill.
- Ruggles-Klingemann Mfg. Co., Salem, Mass.
- Smolensky Valve Co., Inc., Cleveland, O.
- Spence Engineering Co., Inc., Walden, N. Y.
- Weatherhead Co., Cleveland, O.
- Williams Valve Co., D. T., Cincinnati, O.

VAN STONE JOINTS

See Joints, Flanged, Van Stone

V-BELT DRIVES

See Drives, V-Belt

VELOCITY REGULATORS

See Regulators, Air Velocity

VENETIAN BLINDS

See Blinds, Venetian

VENTILATORS, MUSHROOM

- ●American Blower Corp., Detroit, Mich.
- Best Register Co., Milwaukee, Wis.
- Knowles Mushroom Ventilator Co., New York, N. Y.
- Mueller Furnace Co., L. J., Milwaukee, Wis.
- Niagara Blower Co., New York, N. Y.
- ●Sturtevant Co., B. F., Boston, Mass.
- ●Tuttle & Bailey, Inc., New Britain, Conn.
- Ventilating Products Co., Chicago, Ill.

VENTILATORS, ROOF

- Accurate Mfg. Wks., Chicago, Ill.
- Aeolus Dickinson Co., Chicago, Ill.
- Air Controls, Inc., Cleveland, O.
- ●Airtherm Mfg. Co., St. Louis, Mo.
- Akrat Ventilator Co., Chicago, Ill.
- Allen Corp., Detroit, Mich.
- ●American Blower Corp., Detroit, Mich.
- American Foundry & Furnace Co., Bloomington, Ill.
- American-Larson Ventilating Co., Pittsburgh, Pa.
- Ames Co., W. R., San Francisco, Cal.
- Arex Co., Chicago, Ill.
- Autoforce Ventilating System, Boston, Mass.
- ●Autovent Fan & Blower Co., Chicago, Ill. (Power)
- Belanger Fan & Blower Co., Detroit, Mich.
- Burt Mfg. Co., Akron, O.
- Chicago Metal Mfg. Co., Chicago, Ill.
- Davidson Hy Duty Roof Fan Co., Newton, Mass.
- De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
- Falstrom Co., Passaic, N. J.
- Globe Ventilator Co., Troy, N. Y.
- Hirschmann Co., W. F., Buffalo, N. Y.
- Ilg Electric Ventilating Co., Chicago, Ill.
- International Engineering, Inc., Dayton, O.
- Iona Ventilator Co., Inc., Philadelphia, Pa.
- Jamar Co., Walker, Duluth, Minn.
- ●Johnson Fan & Blower Corp., Chicago, Ill.
- Jordan & Co., Paul R., Indianapolis, Ind.
- Kernchen Co., Chicago, Ill.
- King Ventilating Co., Owatonna, Minn.
- Kirk & Blum Mfg. Co., Cincinnati, O.
- Kisco Co., Inc., St. Louis, Mo.
- Kleenaire Corp., Stevens Point, Wis.
- Lee & Son Co., Thomas, Cincinnati, O.
- Mellish & Murray Co., Chicago, Ill.
- Merchant & Evans Co., Philadelphia, Pa.
- Myers Electric Co., Pittsburgh, Pa. (Power)
- National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., Minneapolis, Minn.
- Pioneer Roofing & Sheet Metal Co., Muskogee, Okla.
- Reed Unit-Fans, Inc., New Orleans, La.
- Robertson Co., H. H., Pittsburgh, Pa.
- Royal Ventilator Co., Philadelphia, Pa.
- Schoedinger, F. O., Columbus, O.
- Schwitzer-Cummins Co., Indianapolis, Ind.
- ●Sturtevant Co., B. F., Boston, Mass. (With fan)
- Swartwout Co., Cleveland, O.
- Tierney Rotor Ventilator Co., Minneapolis, Minn.
- Uno Ventilator Co., Cliftondale, Mass.
- Viking Air Conditioning Corp., Cleveland, O.
- Washburne & Co., E. G., New York, N. Y.
- Western Rotary Ventilator Co., Inc., Los Angeles, Cal.
- ●Wing Mfg. Co., L. J., New York, N. Y.

VENTILATORS, UNIT

- ●Johnson Fan & Blower Corp., Chicago, Ill.
- National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., Minneapolis, Minn.
- Nelson Corp., Herman, Moline, Ill.
- ●Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
- New York Blower Co., Chicago, Ill.
- Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
- ●Sturtevant Co., B. F., Boston, Mass.
- ●Trane Co., La Crosse, Wis.

VIBRATION ELIMINATORS

See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration

VIBRATION ISOLATORS

See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration

VISCOUS LIQUID PUMPS

See Pumps, Viscous Liquids

VISES, PIPE

- Armstrong Bros. Tool Co., Chicago, Ill.
- Armstrong Mfg. Co., Bridgeport, Conn.
- Athol Machine & Foundry Co., Chicago, Ill.
- Erie Tool Wks., Erie, Pa.
- Jarecki Mfg. Co., Erie, Pa.
- Hollands Mfg. Co., Erie, Pa.
- Nye Tool & Machine Wks., Chicago, Ill.
- Oster Mfg. Co., Cleveland, O.
- ●Ridge Tool Co., Elyria, O.
- Toledo Pipe Threading Machine Co., Toledo, O.
- Trimont Mfg. Co., Roxbury, Mass.
- Vanderman Mfg. Co., Willimantic, Conn.
- ●Walworth Co., New York, N. Y.
- ●Williams & Co., J. H., New York, N. Y.
- Yost Mfg. Co., Meadville, Pa.

VISE STANDS

See Stands, Vise

WALL THERMOSTATS

See Thermostats, Room or Wall

WARM AIR FURNACES

See Furnaces, Warm Air

WASHERS, AIR

- ●American Blower Corp., Detroit, Mich.
- Ames Co., W. R., San Francisco, Cal.
- ●Autovent Fan & Blower Co., Chicago, Ill.
- Ballantyne Co., Omaha, Nebr.
- Bayley Blower Co., Milwaukee, Wis.
- Belanger Fan & Blower Co., Detroit, Mich.
- Betz Unit Air Cooler Co., Kansas City, Mo.
- Bishop & Babcock Sales Co., Cleveland, O.
- Blower Application Co., Milwaukee, Wis.
- Bubar, Hudson H., New York, N. Y.
- ●Buffalo Forge Co., Buffalo, N. Y.
- Carrier Corp., Syracuse, N. Y.
- ●Clarage Fan Co., Kalamazoo, Mich.
- Electrovent Fan & Mfg. Co., Chicago, Ill.
- Kauffman Air Conditioning Corp., St. Louis, Mo.
- King Ventilating Co., Owatonna, Minn.
- Mellish & Murray Co., Chicago, Ill.
- Montag Stove & Furnace Wks., Portland, Ore.
- Mueller Furnace Co., L. J., Milwaukee, Wis.
- National Air Conditioning & Engineering Corp., Kansas City, Mo.
- National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., Minneapolis, Minn.
- New York Blower Co., Chicago, Ill.
- Niagara Blower Co., New York, N. Y.
- Northern Blower Co., Cleveland, O.
- Nugent Sons, Inc., Thos., New York, N. Y.
- Parks-Cramer Co., Fitchburg, Mass.
- Penn Cooling Tower Wks., Pittsburgh, Pa.
- Polar Air, Inc., Dallas, Texas
- Spray Engineering Co., Somerville, Mass.
- Stilphen Engineering & Mfg. Co., C. A., Denver, Colo.
- Strandwitz & Co., Inc., Camden, N. J.
- ●Sturtevant Co., B. F., Boston, Mass.
- Supreme Heater & Ventilating Corp., St. Louis, Mo.
- ●Trane Co., La Crosse, Wis.
- ●Unit Heater & Cooler Co., Wausau, Wis.
- ●U. S. Air Conditioning Corp., Minneapolis, Minn.
- Utica Radiator Corp., Utica, N. Y.
- Utility Fan & Mfg. Co., Los Angeles, Cal.
- ●Vilter Mfg. Co., Milwaukee, Wis.
- Western Blower Co., Seattle, Wash.
- ●York Ice Machinery Corp., York, Pa.

WATER CHILLERS

See Chillers, Water, for Air Conditioning and Refrigeration

WATER HEATERS

See Heaters, Water

WATER METERS

See Meters, Water

WATER TREATMENT

- American Hydrozone Co., Inc., New York, N. Y.
- Aquatic Chemical Laboratories, Inc., New York, N. Y.
- Bird-Archer Co., New York, N. Y.
- Builders Iron Foundry, Providence, R. I.
- Dampney Co. of America, Boston, Mass.
- Elgin Softener Corp., Elgin, Ill.
- Ferro-Nil Corp., New York, N. Y.
- Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
- Haering Co., D. W., Chicago, Ill.
- Hagan Corp., Pittsburgh, Pa.
- Metropolitan Refining Co., Long Island City, N. Y.

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National Aluminate Corp., Chicago, Ill.
Oakite Products, Inc., New York, N. Y.
Permutit Co., New York, N. Y.
Refinite Corp., Omaha, Neb.
R. U. V. Engineering Corp., New York, N. Y.
Uniflow Mfg. Co., Erie, Pa.
Water Refining Co., Ft. Wayne, Ind.

WATER VAPOR REFRIGERATION

See Compressors, Refrigerating, Centrifugal and Compressors, Refrigerating, Steam Jet

WEATHER STRIPS, METAL

All Metal Weatherstrip Co., Chicago, Ill.
Athey Co., Chicago, Ill.
Burrowes Corp., Portland, Me.
Chamberlain Metal Weather Strip Co., Detroit, Mich.
Higgin Products, Inc., Newport, Ky.
Kane Mfg. Corp., Kane, Pa.
Monarch Metal Weatherstrip Co., St. Louis, Mo.
Northern Weatherstrip Co., Duluth, Minn.
Vento Steel Sash Co., Muskegon, Mich.
Yardley Screen & Weather Strip Co., Columbus, O.

WELDERS, ARC

Adams Mfg. Co., J. D., Indianapolis, Ind.
Air Reduction Sales Co., New York, N. Y.
Alter-Arc Mfg. Co., Lawton, Okla.
Burke Electric Co., Erie, Pa.
Commonwealth Mfg. Corp., Cincinnati, O.
Crise Elec. Mfg. Co., Mt. Vernon, O.
Eisler Engineering Corp., Newark, N. J.
●General Electric Co., Schenectady, N. Y.
General Equipment Co., Wichita, Kan.
Giant Grip Mfg. Co., Oshkosh, Wis.
Hammett Mfg. Co., Kansas City, Mo.
Harnischfeger Corp., Milwaukee, Wis.
Hobart Bros., Troy, O.
Hollup Corp., Chicago, Ill.
Ideal Electric & Mfg. Co., Mansfield, O.
Imperial Electric Co., Akron, O.
Lincoln Electric Co., Cleveland, O.
Maple Valley Mfg. Co., Mapleton, Ia.
Marquette Mfg. Co., Minneapolis, Minn.
Master Welders, Kansas City, Mo.
Miller Electric Mfg. Co., Appleton, Wis.
Ohio Welder Co., Middlefield, O.
Owen-Dyneto Corp., Syracuse, N. Y.
Tatro Bros., Inc., Decorah, Ia.
Una Welding, Inc., E. Cleveland, O.
Universal Power Corp., Cleveland, O.
Vulcan Arc Welder Mfg. Co., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Will-Weld Mfg. Co., Inc., Omaha, Neb.
Wilson Welder & Metals Co., Inc., New York, N. Y.

WELDERS, SPOT

Commonwealth Mfg. Corp., Cincinnati, O.
Eisler Engineering Corp., Newark, N. J.
●General Electric Co., Schenectady, N. Y.
Hammett Mfg. Co., Kansas City, Mo.

WELDING AND CUTTING APPARATUS, OXY-ACETYLENE

Air Reduction Sales Co., New York, N. Y.
Bastian-Blessing Co., Chicago, Ill.
Carbo-Oxygen Co., Pittsburgh, Pa.
Douglass Pipe Machine Co., St. Joseph, Mich.
Gasweld & Airway, Inc., Chicago, Ill.
Harris Calorific Co., Cleveland, O.
Imperial Brass Mfg. Co., Chicago, Ill.
●Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Milburn Co., Alexander, Baltimore, Md.
Oster Mfg. Co., Cleveland, O.
Modern Engineering Co., St. Louis, Mo.
Sight Feed Generator Co., Richmond, Ind.
Smith Welding Equipment Co., Minneapolis, Minn.
Torchweld Equipment Co., Chicago, Ill.

WELDING ROD

See Rod, Welding

WHEELS, BLOWER

Air Controls, Inc., Cleveland, O.
American Blower Corp., Detroit, Mich.
●Autovent Fan & Blower Co., Chicago, Ill.
Bishop & Babcock Sales Co., Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
●Clarage Fan Co., Kalamazoo, Mich.
Economy Electric Mfg. Co., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., Minneapolis, Minn.
New York Blower Co., Chicago, Ill.
Peerless Electric Co., Warren, O.
Schwitzer-Cummins Co., Indianapolis, Ind.
●Sturtevant Co., B. F., Boston, Mass.
●Torrington Mfg. Co., Torrington, Conn.
Viking Air Conditioning Corp., Cleveland, O.

WINDOW VENTILATOR AND FILTER UNITS

See Units, Window Ventilator and Filter

WINDOW WEATHERSTRIP

See Weatherstrip, Window, Metal

WOOD PIPE

See Pipe, Wood

WRENCHES

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Bernz Co., Inc., Otto, Rochester, N. Y.
Billings & Spencer Co., Hartford, Conn.
Blackhawk Mfg. Co., Milwaukee, Wis. (Socket type)
Erie Tool Wks., Erie, Pa.
Greene, Tweed & Co., New York, N. Y.
International Nutype Tool Corp., Oswego, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
●Ridge Tool Co., Elyria, O.
Snap-On Tools, Inc., Kenosha, Wis.
Trimont Mfg. Co., Boston, Mass.
U. S. Hame Co., Buffalo, N. Y.
●Walworth Co., New York, N. Y.
●Williams & Co., J. H., New York, N. Y.

WROUGHT IRON PIPE

See Pipe, Wrought Iron

ZINC SHEETS

See Sheets, Zinc

ZONE CONTROLS

See Systems, Heating, Zone Control

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DIRECTORY SECTION
HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS
PART 2—TRADE NAMES

A

A. B. C.—Ventilators. American Blower Corp., Detroit, Mich.

Abrasoweld—Electrodes. Lincoln Electric Co., Cleveland, O.

A-P—Humidistats, damper operators, regulators, relays, thermostats, valves. Automatic Products Co., Milwaukee, Wis.

ARRC — Couplings, fittings. Union Metal Wks. Inc., Chelsea, Mass.

Absorbex—Insulation. Thermax Div., Northwest Magnesite Co., Pittsburgh, Pa.

Ace—Pipe, pipe and fittings, valves, pumps. American Hard Rubber Co., New York, N. Y.

Acme—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Acousti-Vent—Insulation. Burgess Battery Co., Chicago, Ill.

Adco—Unit heaters, unit air conditioners, unit air coolers. Air Devices Corp., Meriden, Conn.

Adjusto—Packing. Keasbey & Mattison Co., Ambler, Pa.

Adsco—Conduit, covering, joints, meters, regulators, valves. American District Steam Co., North Tonawanda, N. Y.

Adsco-Bannon—Conduit. American District Steam Co., North Tonawanda, N. Y.

Adsco-Becker—Pumps. American District Steam Co., North Tonawanda, N. Y.

Adsco-Corning — Underground conduit insulation. American District Steam Co., North Tonawanda, N. Y.

Aeracool—Blades, fans, ventilators. Myers Electric Co., Pittsburgh, Pa.

Aeratherm—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Aeriet—Fans, unit heaters. Air Devices Corp., Meriden, Conn.

Aero—Radiation. National Radiator Corp., Johnstown, Pa.

Aero-Art—Radiation. National Radiator Corp., Johnstown, Pa.

Aerocrat—Fans, humidifiers, washers. Ames Co., W. R., San Francisco, Cal.

Aeroplex—Fans. Bayley Blower Co., Milwaukee, Wis.

Aerovalve—Ventilators. Knowles Mushroom Ventilator Co., New York, N. Y.

Affco—Dampers, grilles, louvers and shutters, ventilators. American Foundry & Furnace Co., Bloomington, Ill.

Air-Acoustic—Insulation. Johns-Manville, New York, N. Y.

Airblanket—Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Airco—Electrodes, welding rod. Air Reduction Sales Co., New York, N. Y.

Airco-DB—Gages, regulators, torches, welding and cutting apparatus. Air Reduction Sales Co., New York, N. Y.

Airex—Fans, louvers and shutters, unit air humidifiers. Mountain States Equipment Co., Denver, Colo.

Air flo — Dampers, louvers, damper quadrants, draft regulators. Air Conditioning Products Co., Detroit, Mich.

Airfoil—Fans. Aerovent Fan Co., Piqua, O.

Air-Gas-Pop — Valves. Lunkenheimer Co., Cincinnati, O.

Airguide—Hygrometers, thermometers. Fee and Stemwedel, Inc., Chicago, Ill.

Airistocrat—Propeller fan blades. Torrington Mfg. Co., Torrington, Conn.

Airline—Grilles, registers. Tuttle & Bailey, Inc., New Britain, Conn.

Air-Marvels—Fans. General Blower Co., Inc., Philadelphia, Pa.

Air-Master—Grilles, louvers and shutters, registers. Waterloo Register Co., Waterloo, Ia.

Airmat—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Airmat Arrester — Dust collectors. American Air Filter Co., Inc., Louisville, Ky.

Airmeter—Hygrometers. Johnson Tool Co., East Providence, R. I.

Airmixt Sally Mander—Heaters. Williams, Inc., F. C., Dearborn, Mich.

Air-O-Lizer—Ventilators. Trane Co., La Crosse, Wis.

Air-O-Matic—Unit air conditioners, unit air coolers. Williams Oil-O-Matic Corp., Bloomington, Ill.

Airotherm—Zone control thermostat. Tallmadge & Co., Webster, East Orange, N. J.

Air-O-Vent—Ventilators. Trane Co., La Crosse, Wis.

Airplex—Air filters. Davies Air Filter Co., New York, N. Y.

Air Stone—Conduit. Dockstader, S. E., Washington, D. C.

Airvector — Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Akron Red—Packing. Goodrich Co., B. F., Akron, O.

Aladdin—Welders. Commonwealth Mfg. Corp., Cincinnati, O.

Alaska—Surface. Star Radiator Co., Los Angeles, Cal.

All-In-One—Tubing. Wolverine Tube Co., Detroit, Mich.

All-In-One—Unit air conditioners. Airtemp, Inc., Dayton, O.

Almar—Pittsburgh lock forming machines. Ward Machinery Co., Chicago, Ill.

Alnor—Thermometers. Illinois Testing Laboratories, Chicago, Ill.

Alnor Velometer—Anemometers. Illinois Testing Laboratories, Chicago, Ill.

Aloyco—Stainless steel fittings, nipples, pipe, tubing, unions, valves. Alloy Steel Products Co., Linden, N. J.

Aluminweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Alupak—Gaskets, packing. Felt Products Mfg. Co., Chicago, Ill.

Always Reliable—Benders, leak detectors, torches, wrenches. Bernz Co., Inc., Otto, Rochester, N. Y.

Ambler—Cement. Keasbey & Mattison Co., Ambler, Pa.

Amblerite—Packing. Keasbey & Mattison Co., Ambler, Pa.

Ambraloy—Tubing, welding rod. American Brass Co., Waterbury, Conn.

Ambroc—Welding rod. American Brass Co., Waterbury Conn.

Amco—Humidifiers, humidistats, psychrometers, hygrometers. American Moistening Co., Providence, R. I.

Amco—Packing. Austin-Mason Co., New York, N. Y.

American—Couplings. American Flexible Coupling Co., Erie, Pa.

American—Furnaces. American Foundry & Furnace Co., Bloomington, Ill.

American—Shears. American Foundry Equipment Co., Mishawaka, Ind.

American—Dampers, grilles, louvers and shutters. American Warming & Ventilating Co., Toledo, O.

Amirglass—Filters. Amirton Co., New York, N. Y.

Anaconda—Fittings, pipe, welding rod, sheets, solder, tubing, valves. American Brass Co., Waterbury, Conn.

Ankorite—Packing. Anchor Packing Co., Philadelphia, Pa.

Anode—Electrodes. Lincoln Electric Co., Cleveland, O.

Anti-Vibro Block—Bases. Union Fibre Co., Inc., Winona, Minn.

Apex—Quadrants. Ohio Products Co., Cleveland, O.

Apex—Recorders. Uehling Instrument Co., Paterson, N. J.

Apexior—Coatings. Dampney Co. of America, Hyde Park, Boston, Mass.

Apolloy — Sheets. Apollo Steel Co., Apollo, Pa.

Aqualator—Circulators. Triplex Mfg. Co., Peru, Ind.

Aquamiser — Evaporative condensers. Westinghouse Electric & Mfg. Co., Mansfield, O.

Aquaseal — Cement and compounds. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Aquazone—Humidifiers. Corozone Air Conditioning Corp., Cleveland, O.

Arc-Eng—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Arco—Boilers, filters, fittings, pipe, plates, pumps, radiation, regulators, systems, unit air conditioners, valves. American Radiator Co., New York, N. Y.

Arcoblast—Cooling and heating surface. American Radiator Co., New York, N. Y.

Arctic Nu-Air—Fans, grilles. U. S. Air Conditioning Corp., Minneapolis, Minn.

Arex-Austor—Roof ventilators. Arex Co. Chicago, Ill.

Aridifier—Separators. Logan Engineering Co., Chicago, Ill.

Arin—Louvers and shutters. Arex Co., Chicago, Ill.

Aristocrat—Registers. Auer Register Co., Cleveland, O.

Armco—Sheets. American Rolling Mill Co., Middletown, O.

Armco Zincgrip—Galvanized sheets, American Rolling Mill Co., Middletown, O.

Armorak—Pipe covering. Keasbey Co., Robert A., New York, N. Y.

Asbestocel—Covering. Johns-Manville, New York, N. Y.

Asco—Valves, relays, switches. Automatic Switch Co., New York, N. Y.

Ashcolite — Pipe. Allen-Sherman-Hoff Co., Philadelphia, Pa.

Atlas—Dampers. Brown, Wm. P., Springfield, Mass.

Atlas—Dampers. Hampden Cornice Wks., Inc., Springfield, Mass.

Atlas—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Auto-Klean—Filters, strainers. Cuno Engineering Corp., Meriden, Conn.

Automad—Valves. Webster & Co., Warren, Camden, N. J.

Automatic Butler—Stokers. Butler Mfg. Co., Kansas City, Mo.

Autovent—Eliminators, unit air humidifiers, valves. Maid-O-Mist, Inc., Chicago, Ill.

Autozone—Zone control unit. Tallmadge & Co., Webster, East Orange, N. J.

B

B. B.—Electric motors. Brown-Brockmeyer Co., Dayton, O.

B & B—Pumps. Bishop & Babcock Sales Co., Cleveland, O.

BCA—Bearings. Bearings Co. of America, Lancaster, Pa.

B & C—Plates. Beaton & Corbin Mfg. Co., Southington, Conn.

B. & G.—Cement, heaters, relays, regulators, thermostats, valves. Bell & Gossett Co., Chicago, Ill.

B & K—Machines. Bignall & Keeler Machine Wks., Edwardsville, Ill.

B/W—Relays, switches. Bender Warrick Corp., Birmingham, Mich.

B & W—Boilers, burners, pipe, tubing, stokers, valves. Babcock & Wilcox Co., New York, N. Y.

Balmi-Aire—Unit air humidifiers. U. S. Air Conditioning Corp., Minneapolis, Minn.

Barcol—Motors, regulators, thermostats, valves. Barber-Colman Co., Rockford, Ill.

Barnes—Cutters. Erie Tool Works, Erie, Pa.

Barry—Blocks, couplings. Dick Co., Inc., R. & J., Passaic, N. J.

Battleship—Packing. Keasbey & Mattison Co., Ambler, Pa.

Beacor—Valves. Beaton & Corbin Mfg. Co., Southington, Conn.

Bell—Cement. Keasbey & Mattison Co., Ambler Pa.

Belmont—Packing. Belmont Packing & Rubber Co., Philadelphia, Pa.

Benco—Oil burners. Bennett Corp., W. M., Omaha, Neb.

Bendix—Fans. Air Devices Corp., Meriden, Conn.

Bennett-Allison—Oil burners. Bennett Corp., W. M., Omaha, Neb.

Benton—Boilers. Combination Boiler Co., Benton Harbor, Mich.

Berloy—Parts. Berger Mfg. Co., Div. of Republic Steel Corp., Canton, O.

Bertossa — Air conditioning systems. Jackson & Church Co., Saginaw, Mich.

Bifurcator—Fans. De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.

Binoc—Thermometers. Taylor Instrument Companies, Rochester, N. Y.

Bison—Boilers. Farrar & Trefts, Buffalo, N. Y.

Bitugloss — Lacquers and enamels. Wailes Dove-Hermiston Corp., New York, N. Y.

Bloapco—Dust collectors. Blower Application Co., Milwaukee, Wis.

Blo-Matic — Stokers. Her-Born Engineering & Mfg. Co., Sandusky, O.

Blue Ribbon—Hangers or brackets, nipples, plates. Chicago Nipple Mfg. Co., Chicago, Ill.

Box—Air filters. Burt Air Filter Corp., New York, N. Y.

Branford—Unions. Malleable Iron Fittings Co., Branford, Conn.

Brazo—Solder. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Breezo—Fans. Buffalo Forge Co., Buffalo, N. Y.

Buckeye—Unit heaters. Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.

Bull Dog—Pipe, tubing. Phelps Dodge Copper Products Corp., New York, N. Y.

Burnham-Taco — Heaters. Burnham Boiler Corp., Irvington, N. Y.

C

C-E—Boilers. Combustion Engineering Co., New York, N. Y.

CE-Skelly—Stokers. Combustion Engineering Co., Inc., New York, N. Y.

C-H—Controllers and starters, heaters, relays, switches, valves. Cutler-Hammer, Inc., Milwaukee, Wis.

CJB—Bearings. Ahlberg Bearing Co., Chicago, Ill.

C. N. I. — Pipe. Walworth Co., New York, N. Y.

C-S Baro-Lectric—Regulators. Crew-Sargent Controls, Inc., New York, N. Y.

C-S Pressure-Lectric — Regulators. Crew-Sargent Controls, Inc., New York, N. Y.

C-U—Unit heaters. Surface Combustion Corp., Toledo, O.

Cadillac—Meters. Central Station Steam Co., Detroit, Mich.

Cadman—Valves. Barrett Machine Co., N. S., Pittsburgh, Pa.

Calorider—Air washers, dehumidifiers, unit air conditioners. Research Corp., New York, N. Y.

Cameo—Radiation. Weil-McLain Co., Chicago, Ill.

Capitol—Boilers, hangers or brackets, heaters, radiation, unit air conditioners. United States Radiator Corp., Detroit, Mich.

Capitol—Insulation. Standard Lime & Stone Co., Baltimore, Md.

Capitol Fincast — Radiation. United States Radiator Corp., Detroit, Mich.

Capitol ThinTube—Radiation. United States Radiator Corp., Detroit, Mich.

Careycel—Insulation. Carey Co., Philip, Lockland, Cincinnati, O.

Careyduct—Ducts and duct fittings. Carey Co., Philip, Cincinnati, O.

Carrier-Brunswick—Compressors. Carrier Corp., Syracuse, N. C.

Carton—Furnaces. International Heater Co., Utica, N. Y.

Casey-Hedges — Boilers. Combustion Engineering Co., Inc., New York, N. Y.

Castirnarc—Electrodes. Universal Power Corp., Cleveland, O.

Catchdew—Dehumidifiers. Advance Mfg. Co., Inc., Louisville, Ky.

Celoron—Couplings. Continental Diamond Fibre Co., Newark, Del.

Celto—Electrodes, welding rod. Keasbey & Mattison Co., Ambler, Pa.

Centrimax—Meters. Leeds & Northrup Co., Philadelphia, Pa.

Chaco—Cement and compounds, boiler and radiator sealing compounds. Desolvo Mfg. Co., Pittsburgh, Pa.

Champion—Wrenches. Greene, Tweed & Co., New York, N. Y.

Charavay—Propeller fans, unit heaters. Hartzell Propeller Fan Co., New York, N. Y.

Chief—Packing. Keasbey & Mattison Co., Ambler, Pa.

Chieftain — Compressors. Tecumseh Products Co., Tecumseh, Mich.

Chill-Vactor—Steam jet compressors, Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Chinook—Ferrous heating surface. Bayley Blower Co., Milwaukee, Wis.

Chinookfin—Non-ferrous heating surface. Bayley Blower Co., Milwaukee, Wis.

Chromalox — Preheaters, unit heaters. Wiegand Co., Edwin L., Pittsburgh, Pa.

Chromeweld 4-6—Electrodes. Lincoln Electric Co., Cleveland, O.

Chronotherm—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Circle T—Switches. Trumbull Electric Co., Plainville, Conn.

CirCOOLator—Fans, ventilators. Viking Air Conditioning Corp., Cleveland, O.

Clarco—Unit heaters. Clarage Fan Co., Kalamazoo, Mich.

Clark-Sundh — Motor controls. Clark Controller Co., Cleveland, O.

Classic—Registers. Auer Register Co., Cleveland, O.

Clean Air—Unit air humidifiers. Continental Motors Corp., Detroit, Mich.

Cle-Bar—Heaters. Cleghorn Co., Boston, Mass.

Climate Changer—Unit air conditioners, unit air coolers. Trane Co., La Crosse, Wis.

Climate Master — Fan blades. Reed Unit-Fans, Inc., New Orleans, La.

Climax—Regulators. Kieley & Mueller, Inc., New York, N. Y.

Climax—Unions. Devlin Mfg. Co., Inc., Thos., Burlington, N. J.

Clinton — Grilles. Wickwire Spencer Steel Co., New York, N. Y.

Cloth Stocking—Dust collectors. American Air Filter Co., Inc., Louisville, Ky.

Cocheco—Belting. Williams & Son, I. B., Dover, N. H.

Coey—Cooling towers. Research Corp., New York, N. Y.

Cog-Belt—Transmission drives. Dayton Rubber Mfg. Co., Dayton, O.

Colalloy—Alloy pipe and tubing. Colonial Stove Co., Specialties Div., Philadelphia, Pa.

Cold Stream—Surface, unit air conditioners. Baker Ice Machine Co., Inc., Omaha, Nebr.

Colonial — Registers. Auer Register Co., Cleveland, O.

Combustioneer — Stokers. Steel Products Engineering Co., Springfield, O.

Comet—Fans, unit heaters. New York Blower Co., Chicago, Ill.

Comfort—Hygrometers, psychrometers. Hill, E. Vernon, Chicago, Ill.

Comfortrol—Effective temperature control. Friez & Sons, Inc., Julien P., Baltimore, Md.

Comfostat — Thermostats. Johnson Service Co., Milwaukee, Wis.

Compak—Valves. Commonwealth Brass Corp., Detroit, Mich.

Conco—Valves. Capitol Brass Division, Bohn Aluminum & Brass Corp., Detroit, Mich.

Condor—Belting, V belts, pipe. Manhattan Rubber Mfg., Div. of Raybestos Manhattan, Inc., Passaic, N. J.

Control-O-Gas—Regulators. Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.

Convectofin — Radiation. Commodore Heaters Corp., New York, N. Y.

Coolair—Fans. American Coolair Corp., Jacksonville, Fla.

Copes—Governors. Northern Equipment Co., Erie, Pa.

Copotite—Cement and compounds. National Boiler Improvement Co., Washington, D. C.

Cop-R-Loy — Sheets. Wheeling Steel Corp., Wheeling, W. Va.

Coroaire—Heaters. Corozone Air Conditioning Corp., Cleveland, O.

Corto—Radiation. American Radiator Co., New York, N. Y.

Coxe—Boilers, stokers. Combustion Engineering Co., New York, N. Y.

Cradle Coil—Unit heaters. Trane Co., La Crosse, Wis.

Crescent—Burners. Caloroil Burner Corp., Hartford, Conn.

Crescent—Unions. Star Mfg. Co., Inc., Providence, R. I.

Cromaloy—Solder. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Crown-Brand—Cement and compounds. Colebrooks Sons, Inc., W. H., Syracuse, N. Y.

Cub—Unions. Rhode Island Fittings Co., Hillsgrove, R. I.

Curtis — Regulators, traps, valves, d'Este Co., Julian, Charlestown, Mass.

Cycloidal—Air washers. Blower Application Co., Milwaukee, Wis.

Cycloidal Atomizers — Nozzles. Blower Application Co., Milwaukee, Wis.

D

Dart—Unions. Fairbanks Co., New York, N. Y.

Dean—Cleaners. Pierce Co., Wm. B., Buffalo, N. Y.

Decalorator — Compressors. American Blower Corp., Detroit, Mich.

Decalorator — Steam jet compressors. Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.

Deflect-O-Grille—Grilles. U. S. Air Conditioning Corp., Minneapolis, Minn.

Delco-Heat—Burners, condensers, heaters. Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.

DeLuxe—Heaters. Grinnell Co., Inc., Providence, R. I.

Detroit—Traps. Nason Co., Detroit, Mich.

Detroit LoStoker — Stokers. Detroit Stoker Co., Detroit, Mich.

Detroit UniStoker—Stokers. Detroit Stoker Co., Detroit, Mich.

Dexter—Air separators. Leavitt Machine Co., Orange, Mass.

Dezert Kooler—Units. Utility Fan Corp., Los Angeles, Cal.

Diamond Fibre—Gaskets. Continental Diamond Fibre Co., Newark, Del.

Diamond H — Switches, thermostats. Hart Mfg. Co., Hartford, Conn.

Dickbelt—Belting, drives. Dick Co., Inc., R. & J., Passaic, N. J.

Dickrope—Belts, drives. Dick Co., Inc., R. & J., Passaic, N. J.

Difr-enshal-Vacm — Heating systems. Dunham Co., C. A., Chicago, Ill.

Differential — Thermostats. Johnson Service Co., Milwaukee, Wis.

Dilecto—Insulation. Continental Diamond Fibre Co., Newark, Del.

Discfin—Cooling surface. General Refrigeration Corp., Beloit, Wis.

Disc-Loc—Grilles. Knowles Mushroom Ventilator Co., New York, N. Y.

Domic—Heaters. Central Radiator Co., New York, N. Y.

Dominion—Gaskets, packing. Darcoid Co., Inc., New York, N. Y.

Double Diamond—Hygrometers, recorders, psychrometers. H-B Instrument Co., Philadelphia, Pa.

Double Duty—Air filters. Independent Air Filter Co., Chicago, Ill.

Double-Seal—Copper tube fittings. Hays Mfg. Co., Erie, Pa.

Draftite—Cement. Keasbey & Mattison Co., Ambler, Pa.

Draftrite—Gages. Bacharach Industrial Instrument Co., Pittsburgh, Pa.

Drainator — Traps. Coe Mfg. Co., Painesville, O.

Dri-Cool—Unit air humidifiers. U. S. Air Conditioning Corp., Minneapolis, Minn.

Dry-Matic—Air filters. Coppus Engineering Co., Worcester, Mass.

Dry-paC—Covering. Ric-wiL Co., Cleveland, O.

Dual — Thermostats. Johnson Service Co., Milwaukee, Wis.

Dualsteel—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Dul-Kote — Sheets. Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

Dunco—Relays, thermostats. Dunn, Inc., Struthers, Philadelphia, Pa.

Duo-Stat—Heating systems, thermostats. Johnson Service Co., Milwaukee, Wis.

Duo-Stat—Thermostats. Raymond Co., F. I., Chicago, Ill.

Duplex—Machines. Bignall & Keeler Machine Wks., Edwardsville, Ill.

Duplex—Covering. Keasbey & Mattison Co., Ambler, Pa.

DuraBilt—Registers. Auer Register Co., Cleveland, O.

Durco—Pipe. Duriron Co., Inc., Dayton, O.

Duro—Valves. Lunkenheimer Co., Cincinnati, O.

Duroline — Pipe. National Tube Co., Pittsburgh, Pa.

Duronze—Silicon bronze rod. Bridgeport Brass Co., Bridgeport, Conn.

Dust-Stop—Air filters. Owens-Illinois Glass Co., Toledo, O.

Dustube — Dust collectors. American Foundry Equipment Co., Mishawaka, Ind.

Dux-Sulation—Insulation. Wilson, Inc., Grant, Chicago, Ill.

E

EC & M—Motor controls. Electric Controller & Mfg. Co., Cleveland, O.

Enfco—Fittings. Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.

Easy-Flo—Solder. Handy & Harman, New York, N. Y.

Easyweld—Electrodes. Universal Power Corp., Cleveland, O.

Eclipse—Governors, regulators, traps, valves. Illinois Engineering Co., Chicago, Ill.

Economizer—Cooling towers. York Ice Machinery Corp., York, Pa.

Economy—Boilers, heaters. International Heater Co., Utica, N. Y.

Economy — Registers. Auer Register Co., Cleveland, O.

Economy — Stokers. Christensen Machine Co., Salt Lake City, Utah.

Economy—Unit ventilators. Arex Co., Chicago, Ill.

Egniflo — Valves. Grinnell Co., Inc., Providence, R. I.

Electrap—Pumps. Johnson Corp., Three Rivers, Mich.

Electra-Vac—Pumps. Johnson Corp., Three Rivers, Mich.

Electromode—Electric heaters. Electric Air Heater Co., Div. American Foundry Equipment Co., Mishawaka, Ind.

Electronite — Stainless steel tubing. Steel and Tubes, Inc., Cleveland, O.

Electro-Sheet—Sheets. American Brass Co., Waterbury, Conn.

Electrozone—Ozone apparatus. Triox Engineering Co., St. Louis, Mo.

Elite—Registers. Auer Register Co., Cleveland, O.

Emco—Regulators. Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Empire—Bolts and studs. Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

Enco—Burners, regulators. Engineer Co., New York, N. Y.

Enduro—Packing. Keasbey & Mattison Co., Ambler, Pa.

Enduro—Pipe, sheets, tubing. Republic Steel Corp., Cleveland, O.

Enduro—Unions. Lockport Fittings Co., Inc., Lockport, N. Y.

Equalizing — Valves. Gorton Heating Corp., Cranford, N. J.

Equarad—Zone control radiator valve. Tallmadge & Co., Webster, East Orange, N. J.

Equatherm—Zone control thermostat. Tallmadge & Co., Webster, East Orange, N. J.

Eskimo—Surface. Star Radiator Co., Los Angeles, Cal.

Esotoo—Refrigerant. Virginia Smelting Co., West Norfolk, Va.

Eureka—Regulators, valves. Kieley & Mueller, Inc., New York, N. Y.

Evactor — Pumps. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Evalpak—Packing. Edward Valve & Mfg. Co., Inc., East Chicago, Ind.

Evco—Valves. Electric Valve Mfg. Co., Inc., New York, N. Y.

Evenaction—Valves. Taylor Instrument Companies, Rochester, N. Y.

Everdur—Pipe, sheets, tubing, welding rod. American Brass Co., Waterbury, Conn.

Excel—Unions. Lockport Fittings Co., Inc., Lockport, N. Y.

Exhaustair—Fans. New York Blower Co., Chicago, Ill.

Eye-Hye—Gages. Reliance Gauge Column Co., Cleveland, O.

F

F & E—Stokers. Flynn & Emrich Co., Baltimore, Md.

FAB—Unions. Lockport Fittings Co., Inc., Lockport, N. Y.

FAB—Unions. Standard Union Co., Lockport, N. Y.

Fabrikated—Grilles, registers. Independent Register Co., Cleveland, O.

Falcon—Heaters. Swoboda, Inc., H. O., New Brighton, Pa.

Fantom—Radiation. American Radiator Co., New York, N. Y.

Faragut—Packing. Darcoid Co., Inc., New York, N. Y.

Featherfin — Heating surface. Wing Mfg. Co., L. J., New York, N. Y.

Featherweight—Cement, covering. Keasbey & Mattison Co., Ambler, Pa.

Featherweight — Unit heaters. Wing Mfg. Co., L. J., New York, N. Y.

Fel-Pro—Gaskets, packing. Felt Products Mfg. Co., Chicago, Ill.

Ferrenewo—Valves. Lunkenheimer Co., Cincinnati, O.

Ferroclad—Insulation. Truscon Steel Co., Youngstown, O.

Ferrocraft—Grilles, registers. Tuttle & Bailey, Inc., New Britain, Conn.

Ferroflo—Grilles. Tuttle & Bailey, Inc., New Britain, Conn.

Ferrogrid—Registers, Tuttle & Bailey, Inc., New Britain, Conn.

Ferro-Therm — Insulation. American Flange & Mfg. Co., Inc., New York, N. Y.

Ferroweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Fiberglas — Cement, covering, insulation. Owens-Illinois Glass Co., Toledo, O.

Fibrofelt—Insulation. Union Fibre Co., Inc., Winona, Minn.

Fields—Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Filmflo—Deaerators, separators. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Filteraire — Window ventilator and filter units. Davies Air Filter Co., New York, N. Y.

Findlay—Stokers. Bluffton Mfg. Co., Findlay, O.

Flash—Heaters. Cleghorn Co., Boston, Mass.

Fleetweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Flexcord—Drives. Gates Rubber Co., Denver, Colo.

Flexeal—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Flexodisc—Expansion joints. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Flextan—Packing. Chicago Belting Co., Chicago, Ill.

Flo-Klean—Filters, strainers. Cuno Engineering Corp., Meriden, Conn.

Flush Kleen—Ejectors. Chicago Pump Co., Chicago, Ill.

Forbes Syphonaire—Ventilators. Western Rotary Ventilator Co., Inc., Los Angeles, Cal.

Forcedraft—Unit air coolers. Fedders Mfg. Co., Inc., Buffalo, N. Y.

Force-Flo—Circulators, heaters, regulators, systems. Stevens-Root Co., Chicago, Ill.

Francke—Flexible couplings. Waldron Corp., John, New Brunswick, N. J.

Freeflo—Grilles. Trane Co., La Crosse, Wis.

"Freon"—Refrigerant. Kinetic Chemicals, Inc., Wilmington, Del.

Fretz—Nipples. Devlin Mfg. Co., Inc., Thos., Burlington, N. J.

Frevent—Valves. Russell & Co., W. A., New York, N. Y.

Fulscope — Recorders, recorder-controllers, regulators, Taylor Instrument Companies, Rochester, N. Y.

Frigitower—Cooling towers. Schubert-Christy Corp., St. Louis, Mo.

fYBa—Motor operated valves. Barber-Colman Co., Rockford, Ill.

Fyr-Feeder — Stokers. American Coal Burner Co., Chicago, Ill.

G

G.B.C.—Circulators, couplings. General Blower Co., Inc., Philadelphia, Pa.

G & M—Stokers. Stokermatic Co., Salt Lake City, Utah.

Gallery — Grilles. Knowles Mushroom Ventilator Co., New York, N. Y.

Gardnerench—Tongs. Billings & Spencer Co., Hartford, Conn.

Gas Era—Boilers. L. J. Mueller Furnace Co., Milwaukee, Wis.

Gast—Filters, separators. Johnson Corp., Three Rivers, Mich.

Gasteam—Radiation. Clow, Jas. B. & Sons, Chicago, Ill.

Geddes—Radiation. Fowler & Wolfe Radiator Co., Norristown, Pa.

Gemware — Hygrometers, psychrometers, thermometers. G. M. Mfg. Co., New York, N. Y.

Genasco—Cement and compounds, insulation. Barber Co., Inc., Philadelphia, Pa.

Genuine Detroit—Gages, humidistats, operators, switches, thermostats, valves. Detroit Lubricator Co., Detroit, Mich.

Genuine Stillson—Wrenches. Walworth Co., New York, N. Y.

Geyser—Water heaters. Thatcher Co., Newark, N. J.

Giant—Unit heaters, Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.

Gilbarco—Burners, heaters. Gilbert & Barker Mfg. Co., Springfield, Mass.

Gilt Edge—Belting. Rhoads & Sons, J. E., Wilmington, Del.

Gimco—Insulation. General Insulating & Mfg. Co., Alexandria, Ind.

Gland-Pakt — Expansion joints. Yarnall-Waring Co., Philadelphia, Pa.

Gloco Red Band—Water heaters. Glore Sales Corp., Evins F., New York, N. Y.

Goetzerit—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Gohi—Sheets. Newport Rolling Mill Co., Newport, Ky.

Goss—Humidistats. Ripley Co., W. R. Tacoma, Wash.

Gothic — Radiation. Thatcher Co., Newark, N. J.

Green—Stokers. Combustion Engineering Co., Inc., New York, N. Y.

Grid—Unit heaters. Unit Heater & Cooler Co., Wausau, Wis.

Grillometer—Direct reading air velocity meters. Detroit Air Meter Co., Detroit, Mich.

Gripbelts—Belts. Browning Mfg. Co., Inc., Ohio Valley Pulley Works, Div., Maysville, Ky.

Gulfsteel—Electrodes, sheets. Gulf States Steel Co., Birmingham Ala.

Gun-Pakt—Expansion joints. Yarnall-Waring Co., Philadelphia, Pa.

Guthfan—Fans. Guth Co., Edwin F., St. Louis, Mo.

H

H-B—Boilers. Smith Co., H. B., Westfield, Mass.

H & C—Dampers, grilles, registers. Hart & Cooley Mfg. Co., Chicago, Ill.

H & C—Regulators. Watson & McDaniel Co., Philadelphia, Pa.

H-O-H—Compounds, water treatment. Haering & Co., Inc., D. W., Chicago, Ill.

Hager—Valves. Williams Gauge Co., Pittsburgh, Pa.

Hairbestos—Insulation. Wilson & Co., Chicago, Ill.

Hancock—Valves. Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.

Handy — Valves. Lunkenheimer Co., Cincinnati, O.

Handy Andy—Vise stands. Western Wire Products Co., St. Louis, Mo.

Handy Flux—Solder. Handy & Harman, New York, N. Y.

Hanite Metallo — Packing. Metallo Gasket Co., New Brunswick, N. J.

Hardweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Haveg—Pipe, tanks. Continental Diamond Fibre Co., Newark, Del.

Hawks—Burners, humidifiers. Hugo Mfg. Co., West Duluth, Minn.

Heat Fan—Unit heaters. Air Devices Corp., Meriden, Conn.

Heat-Saver — Humidifiers. U. S. Air Conditioning Corp., Minneapolis, Minn.

Heavy Duty—Furnaces. International Heater Co., Utica, N. Y.

Helical—Tubing. Rome-Turney Radiator Co., Rome, N. Y.

Helmet Seal — Thermostats. National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.

Hensel—Welders. Maple Valley Mfg. Co., Mapleton, Ia.

Herculoy—Sheets, tubing, welding rod. Revere Copper & Brass, Inc., New York, N. Y.

Hevikoat—Electrodes. Universal Power Corp., Cleveland, O.

Highflex—Belting. Goodrich Co., B. F., Akron, O.

High-Temp—Packing. Keasbey & Mattison Co., Ambler, Pa.

Highway—Sheets. Apollo Steel Co., Apollo, Pa.

Hilger—Coils, refrigerating compressors, unit coolers, dehumidifiers, cooling towers, unit air conditioners. XL Refrigerating Co., Inc., Chicago, Ill.

Hi-Lo—Pumps. Yeomans Bros. Co., Chicago, Ill.

Hi-Spra — Spray nozzles. Schubert-Christy Corp., St. Louis, Mo.

Hitchings—Boilers. Burnham Boiler Corp., Irvington, N. Y.

Hi-Test—Pipe. Walworth Co., New York, N. Y.

Hitoncast—Grilles, registers. Tuttle & Bailey, Inc., New Britain, Conn.

Hoffman-Economy — Pumps. Hoffman Specialty Co., Inc., Waterbury, Conn.

Hoffman Economy — Pumps. Economy Pumps, Inc., Chicago, Ill.

Holby—Valves. Boiler Room Equipment, Inc., New York, N. Y.

Holdfast—Solder. American Brass Co., Waterbury, Conn.

Holt—Strainers. Rosedale Foundry & Machine Co., Pittsburgh, Pa.

Horton—Tanks. Chicago Bridge & Iron Wks., Chicago, Ill.

Hovalco — Valves. Homestead Valve Mfg. Co., Coraopolis, Pa.

Huber—Stokers. Flynn & Emrich Co., Baltimore, Md.

Humidiguide—Hygrometers. Taylor Instrument Companies, Rochester, N. Y.

Humidostat — Humidistats. Johnson Service Co., Milwaukee, Wis.

Humi-Temps—Unit air coolers. Larkin Refrigerating Corp., Atlanta, Ga.

Humitherm—Unit air conditioners, unit air humidifiers. Grinnell Co., Inc., Providence, R. I.

Humitrol — Hygrometers. Mayflower-Lewis Corp., St. Paul, Minn.

Humphrey—Unit heaters. General Gas Light Co., Kalamazoo, Mich.

Hycarb—Electrodes. Universal Power Corp., Cleveland, O.

Hydramotor—Valves. General Controls Co., San Francisco, Cal.

Hydro—Recorders. Bacharach Industrial Instrument Co., Pittsburgh, Pa.

Hydro — Packing. Keasbey & Mattison Co., Ambler, Pa.

Hydro—Valves. Kieley & Mueller, Inc., New York, N. Y.

Hydrolator—Circulators. Janette Mfg. Co., Chicago, Ill.

Hydron—Bellows. Clifford Mfg. Co., Boston, Mass.

Hydrozone—Ionization and ozone apparatus, water treatment. American Hydrozone Co., Inc., New York, N. Y.

Hy-Duty — Fans. Schwitzer-Cummins Co., Indianapolis, Ind.

Hylo—Heating systems. Webster & Co., Warren, Camden, N. J.

Hy-Temp—Cement, covering. Keasbey & Mattison Co., Ambler, Pa.

Hy-Temp Combination — Covering. Keasbey & Mattison Co., Ambler, Pa.

Hy-Test—Water heaters. Smith Co., H. B., Westfield, Mass.

Hytherstat—Combination humidity and temperature control. Friez & Sons, Inc., Julien P., Baltimore, Md.

I

I-R—Ingersoll-Rand, New York, N. Y.

Ice-O-Matic—Refrigerating compressors. Williams Oil-O-Matic Heating Corp., Bloomington, Ill.

Ideal—Boilers, water heaters, valves. American Radiator Co., New York, N. Y.

Ideal—Ventilators. Tuttle & Bailey, Inc., New Britain, Conn.

Ideal—Traps. Nason Co., Detroit, Mich.

Immersatherm — Thermostats. Mercoid Corp., Chicago, Ill.

Impact—Spray nozzles. Cooling Tower Co., Inc., New York, N. Y.

Imperial—Boilers. National Radiator Corp., Johnstown, Pa.

In-Cel-Wood—Insulation. Cornell Wood Products Co., Chicago, Ill.

IngAclad—Stainless clad sheets. Ingersoll Steel & Disc Co., Chicago, Ill.

Insertion Thermostat — Thermostats. Johnson Service Co., Milwaukee, Wis.

Instant—Heaters, preheaters. Johnson Corp., Three Rivers, Mich.

Instant—Water heaters. Sterling Engineering Co., Milwaukee, Wis.

Insulfil—Insulation. Refractory & Insulation Corp., New York, N. Y.

Insulroc — Insulation. Rock Products Co., Nashville, Tenn.

Insulwool—Insulation. General Insulating Products Co., Brooklyn, N. Y.

Ironton—Burners. Continental Stove Corp., Ironton, O.

J

J—Fittings, flanges, unions. Jenkins Mfg. Co., New York, N. Y.

J-M—Traps. Cryer Trap & Valve Co., Inc., New York, N. Y.

J. M. C.—Burners. Johnson Mfg. Co., Waterloo, Ia.

Jacknife—Hygrometers, psychrometers. Hill, E. Vernon, Chicago, Ill.

Janitrol—Burners, furnaces, heaters, unit air conditioners, unit air humidifiers. Surface Combustion Corp., Toledo O.

Jarco—Unions. Jarecki Mfg. Co., Erie, Pa.

Jennings—Pumps, ejectors. Nash Engineering Co., South Norwalk, Conn.

Jewel—Packing. Keasbey & Mattison Co., Ambler, Pa.

Jointite—Insulation. Mundet Cork Corp., New York, N. Y.

Jones—Stokers. Riley Stoker Corp., Worcester, Mass.

K

K—Fittings. Kuhns Brothers Co., Dayton, O.

Kable Kord—Belting. L. H. Gilmer Co., Philadelphia, Pa.

Kamanco—Water heaters. Mears-Kane-Ofeldt Inc., Philadelphia, Pa.

Kane—Boilers, gas burners. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Kathabar—Dehumidifiers, unit air conditioners. Surface Combustion Corp., Toledo, O.

Kelly—Valves. National Metal Products Corp., Chicago, Ill.

Kentucky—Sheets. Newport Rolling Mill Co., Newport, Ky.

Key Graphite Paste—Cement and compounds. Key Co., East St. Louis, Ill.

Key-Tite—Cement and compounds. Key Co., East St. Louis, Ill.

Kidskin—Packing. Darcoid Co., Inc., New York N. Y.

King-clip—Valves. Lunkenheimer Co., Cincinnati, O.

Klinger—Valves. Klingerit, Inc., New York, N. Y.

Klixon—Temperature controls. Spencer Thermostat Co., Attleboro, Mass.

K-Master—Strainers, traps. Kaye & Macdonald, Inc., West Orange, N. J.

Koilfin—Electric heaters. Wiegand Co., Edwin L., Pittsburgh, Pa.

Kompak—Air filters. Independent Air Filter Co., Chicago, Ill.

Kooler-Aire—Commercial air conditioners. U. S. Air Conditioning Corp., Minneapolis, Minn.

Kramer—Condensers, heaters, radiation, surface, tubing. Trenton Auto Radiator Wks., Trenton, N. J.

Kromax — Packing. Watson-Stillman Co., Roselle, N. J.

Kroy — Unit heaters. Carrier Corp., Syracuse, N. Y.

Kwic-Lift—Hangers or brackets. Sterling Engineering Co., Milwaukee, Wis.

Kwik Konnectors — Fittings. Colonial Stove Co., Specialties Div., Philadelphia, Pa.

L

L. A.—Motors. Louis Allis Co., Milwaukee, Wis.

L&N—Regulators. Leeds & Northrup Co., Philadelphia, Pa.

L-R—Couplings. Lovejoy Tool Works, Chicago, Ill.

L. R. D.—Valves. Grinnell Co., Inc., Providence, R. I.

Laddi—Heaters. Johnson Co., S. T. Oakland, Cal.

Lamino—Covering. Keasbey & Mattison Co., Ambler, Pa.

Lansdale—Heaters. Central Radiator Co., New York, N. Y.

Lasten—Water heaters, Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Lavigne—Valves. Commonwealth Brass Corp., Detroit, Mich.

Lawson—Wrenches. U. S. Hame Co., Buffalo, N. Y.

Leader—Boilers, burners. Pressure Oil Burners, Inc., York, Pa.

Lectrodryer—Dehumidifiers, unit air conditioners. Pittsburgh Lectrodryer Corp., Pittsburgh, Pa.

Lectro Shear—Shears. Black & Decker Mfg. Co., Towson, Md.

Levelometer — Gages. Liquidometer Corp., Long Island City N. Y.

Limpet—Insulation. Keasbey & Mattison Co., Ambler, Pa.

Linc-Weld—Motors. Lincoln Electric Co., Cleveland, O.

Linofelt—Insulation. Union Fibre Co., Winona, Minn.

Lipman—Compressors, heat exchangers, cooling surface, unit air conditioners. General Refrigeration Corp., Beloit, Wis.

Liquivator—Pumps. Morehead Mfg. Co., Detroit, Mich.

Little Giant—Switches. Tork Clock Co., Inc., Mt. Vernon, N. Y.

Lo-Blast—Burners. National Machine Wks., Chicago, Ill.

Locarb—Electrodes. Universal Power Corp., Cleveland, O.

Lock Ring Seal—Packing. Williams Gauge Co., Pittsburgh, Pa.

Logan—Radiation. Logansport Radiator Equipment Co., Logansport, Ind.

Lord Burnham—Boilers. Burnham Boiler Corp., Irvington, N. Y.

Lowcost—Boilers. Murray Iron Wks. Co., Burlington, Ia.

Lubricore—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Luminare—Electrodes. Universal Power Corp., Cleveland, O.

Lyonore—Sheets. Lyon, Conklin & Co., Inc., Baltimore, Md.

M

M & E—Refrigerating compressors. Merchant & Evans Co., Philadelphia, Pa.

M & M—Feeders, switches, valves. McDonnell & Miller, Chicago, Ill.

MIF—Clamps, couplings, fittings. Malleable Iron Fittings Co., Branford, Conn.

MJL—Manometers, meters, recorders. Morey & Jones, Ltd., Los Angeles, Cal.

MKO—Boiler feeders. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Macheta—Fans. Aerovent Fan Co., Piqua, O.

Magic—Boilers. Joliet Heating Corp., Joliet, Ill.

Magicaire—Unit heaters. Schoedinger, F. O., Columbus, O.

Magic-Weather—Air washers, fans, unit air coolers. Scott Ballantyne Co., Omaha, Nebr.

Majestic—Boilers. Ames Iron Wks., Div. of Pierce Butler Radiator Corp., Oswego, N. Y.

Manganweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Martel — Cooling towers. Schubert-Christy Corp., St. Louis, Mo.

Martell—Packing. France Packing Co., Tacony, Philadelphia, Pa.

Massachusetts — Fans, Unit heaters, blower wheels, air washers. Bishop & Babcock Sales Co., Cleveland, O.

Master—Thermostats. White Mfg. Co., St. Paul, Minn.

Master—Unions. Lockport Fittings Co., Inc., Lockport, N. Y.

Mayflower—Refrigerating compressors, cooling surface, unit air coolers. Hardy Mfg. Co., Inc., Dayton, O.

McDaniel—Eliminators, floats, traps. Watson & McDaniel Co., Philadelphia, Pa.

McKee—Blowers, boilers, burners, feeders, pumps, regulators, tanks, torches, valves. Eclipse Fuel Engineering Co., Rockford, Ill.

McKeesport — Radiation. Columbia Radiator Co., McKeesport, Pa.

McKnight—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Mechanovent—Ventilators. New York Blower Co., Chicago, Ill.

Mel-Rock — Ducts and duct fittings, humidifiers, units, ventilators, washers. Mellish & Murray Co., Chicago, Ill.

Menlo—Water heaters. Smith Co., H. B., Westfield, Mass.

Merkustat — Regulators, switches. Marsh Corp., Jas. P., Chicago, Ill.

Metrotherm — Thermostats. General Controls Co., San Francisco, Cal.

Micromax—Psychrometers, recorders, recorder-controllers, thermometers. Leeds & Northrup Co., Philadelphia, Pa.

Microstat—Thermostats. Friez & Sons, Inc., Julien P., Baltimore, Md.

Midas—Welders. Commonwealth Mfg. Corp., Cincinnati, O.

Midget — Radiation. Utica Radiator Corp., Utica, N. Y.

Mills—Boilers. Smith Co., H. B., Westfield, Mass.

Milvaco — Air eliminators, feeders, strainers, traps, unions, valves. Milwaukee Valve Co., Milwaukee, Wis.

Milwaukee—Heaters. Blower Application Co., Milwaukee, Wis.

Milwaukee—Window ventilator and filter units. Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.

Milwaukee—Stokers. Automatic Stoker Corp., Milwaukee, Wis.

Minfelt—Cement, pipe covering. Mineral Felt Co., Toledo, O.

MKayO—Boilers. Mears - Kane - Ofeldt, Inc., Philadelphia, Pa.

Mobilaire—Unit air coolers. Westinghouse Electric & Mfg. Co., Mansfield, O.

Moderator—Heating system. Warren Webster Co., Camden, N. J.

Modulation—Valves. Webster & Co., Warren, Camden, N. J.

Modutrol—Heating systems. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Mohawk—Pipe. Cohoes Rolling Mill Co., Cohoes, N. Y.

Monarch—Furnaces. Forest City Foundries Co., Cleveland, O.

Moncrief—Furnaces, sheet metal pipe and fittings. Henry Furnace & Foundry Co., Cleveland, O.

Mono-Cast—Pipe. American Cast Iron Pipe Co., Birmingham, Ala.

Monoloy—Pipe. American Cast Iron Pipe Co., Birmingham, Ala.

Moore—Hangers, brackets, inserts. Carty & Moore Engineering Co., Detroit, Mich.

Morflex — Flexible couplings. Morse Chain Co., Ithaca, N. Y.

Mortex—Cement, insulation. Mortell Co., J. W., Chicago, Ill.

Mosher—Separators. Barrett Machine Co., N. S., Pittsburgh, Pa.

Motoco—Recorders, thermometers, Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.

Motopump—Pumps. Yeomans Bros. Co., Chicago, Ill.

Motor-Mount—Pumps. Deming Co., Salem, O.

Motorstoker—Stokers. Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.

Multiflex—Valves. Wheeler Mfg. Co., C. H., Philadelphia, Pa.

Multi-Panel—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Multiseal—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Multitherm — Air Conditioning Units. Clarage Fan Co., Kalamazoo, Mich.

Multi-V—V Belts. Goodrich Co., B. F., Akron, O.

Multivane—Fans and blowers. B. F. Sturtevant Co., Boston, Mass.

Multy-Seal—Packing. Keasbey & Mattison Co., Ambler, Pa.

Murray—Radiation. American Radiator Co., New York, N. Y.

N

N-M-D—Valves. Lunkenheimer Co., Cincinnati, O.

Nash Hytor—Pumps. Nash Engineering Co., South Norwalk, Conn.

National—Compressors. Janette Mfg. Co., Chicago, Ill.

National—Pumps. Austin-Mason Co., New York, N. Y.

National-Shelby—Tubing. National Tube Co., Pittsburgh Pa.

Naturzone—Insulation. Wilson & Co., Chicago, Ill.

Nelco—Insulation. Nelson Mfg. Co., B. F., Minneapolis, Minn.

Nemo—Insulating cement. Smith & Kanzler, Inc., Elizabeth, N. J.

New Cyclone—Dust collectors. Kirk & Blum Mfg. Co., Cincinnati, O.

New Kathode — Electrodes. Lincoln Electric Co., Cleveland, O.

New Lightweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Newport—Humidistats. Johnson Tool Co., East Providence, R. I.

New Standard—Traps. Kieley & Mueller, Inc., New York, N. Y.

Niagara—Furnaces. Forest City Foundries Co., Cleveland, O.

Niagara — Meters, strainers. Buffalo Meter Co., Buffalo, N. Y.

Ni-Resist—Pipe. Walworth Co., New York, N. Y.

Non-clog—Sewage ejectors. Chicago Pump Co., Chicago, Ill.

Non-Con-Dux—Cement, covering, pipe. Wilson, Inc., Grant, Chicago, Ill.

Non-Frost—Covering. Keasbey & Mattison Co., Ambler, Pa.

Non-Sweat—Covering. Keasbey & Mattison Co., Ambler, Pa.

Norblo—Dust collectors, fans, filters, washers. Northern Blower Co., Cleveland, O.

Nordstrom—Valves. Merco-Nordstrom Valve Co., Pittsburgh, Pa.

Northern Breeze—Unit air coolers. Chicago Pump Co., Chicago, Ill.

Northwind—Unit air coolers. Pleasantaire Corp., Washington, D. C.

Norwestco—Cement and compounds, boiler and radiator sealing compounds. Northwestern Chemical Co., Marietta, O.

No-Thread—Fittings. Dresser Mfg. Co., S. R., Bradford, Pa.

No-Ve-U—Door ventilators. Waterloo Register Co., Waterloo, Ia.

Novoid—Insulation. Cork Import Corp., New York, N. Y.

Novus — Boilers. National Radiator Corp., Johnstown, Pa.

Nu-Air—Fans. Meier Electric & Machine Co., Indianapolis, Ind.

Nu - Notch — Mushroom ventilators. Knowles Mushroom Ventilator Co., New York, N. Y.

O

OB—Valves. Ohio Brass Co., Mansfield, O.

OK—Motors. Marathon Electric Mfg. Corp., Wausau, Wis.

Oblong—Grilles. Knowles Mushroom Ventilator Co., New York, N. Y.

OCECO—Pumps. Johnston & Jennings Co., Cleveland, O.

Ofeldt—Boilers, regulators. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Oil-O-Matic—Oil burners. Williams Oil-O-Matic Heating Corp., Bloomington, Ill.

Ol' Faithful — Unit air humidifiers. Maid-O-Mist, Inc., Chicago, Ill.

1, 2, 3 (Boiler treatment)—Boiler cleaning compounds. Dole Valve Co., Chicago, Ill.

Oxford—Unions. Standard Union Co., New York, N. Y.

Oxweld—Welding rod, welding and cutting apparatus. Linde Air Products Co., The, New York, N. Y.

P

PDQC — Pipe machines. Bignall & Keeler Machine Wks., Edwardsville, Ill.

P & H—Motors. Harnischfeger Corp., Milwaukee, Wis.

P & H—Hansen—Arc Welders. Harnischfeger Corp., Milwaukee, Wis.

Pacific—Boilers. United States Radiator Corp., Detroit, Mich.

Paintgrip — Sheets. American Rolling Mill Co., Middletown, O.

Palco—Packing. Greene, Tweed & Co., Co., New York, N. Y.

Palco Bark—Insulation. Pacific Lumber Co., San Francisco, Cal.

Palmetto—Packing. Greene, Tweed & Co., New York, N. Y.

Paracoil—Heaters, heat exchangers, preheaters. Davis Engineering Corp., Elizabeth, N. J.

Parko—Psychrometers. Parks-Cramer Co., Fitchburg, Mass.

Paxtite — Packing. Watson-Stillman Co., Roselle, N. J.

Pebble—Registers. Auer Register Co., Cleveland, O.

Peerless—Dust collectors, humidifiers, air washers. New York Blower Co., Chicago, Ill.

Peerless—Pipe machines. Bignall & Keeler Machine Works, Edwardsville, Ill.

Peerless—Boilers, heaters. Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.

Peerless—Pumps. Peerless Pump Div., Food Machinery Corp., Massillon, O.

Penn-M-Co—Fittings. Penn Mfg. Corp. of Washington, Pa., Washington, Pa.

Perfection—Plates. Beaton & Cadwell Mfg. Co., New Britain, Conn.

Perfection—Regulators, valves. American District Steam Co., North Tonawanda, N. Y.

Permanite—Packing. Keasbey & Mattison Co., Ambler, Pa.

Permopad — Air filters. Independent Air Filter Co., Chicago, Ill.

Petro—Oil burners. Petroleum Heat & Power Co., Stamford, Conn.

Pipemaster—Wrenches. Erie Tool Wks., Erie, Pa.

Plastiseal — Cement and compounds. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Playford—Stokers. Rosedale Foundry & Machine Co., Pittsburgh, Pa.

Plexifin—Unit heaters. Bayley Blower Co., Milwaukee, Wis.

Plexiform—Fans. Bayley Blower Co., Milwaukee, Wis.

Plumrite—Pipe. Bridgeport Brass Co., Bridgeport, Conn.

Plymco—Air filters. Plymouth Cordage Co., N. Plymouth, Mass.

Poly-Stage—Air filters. Burt Air Filter Corp., New York, N. Y.

Pomona-Niagara — Pumps. Pomona Pump Co., Pomona, Cal.

Pottstown—Pumps. Martocello & Co., Jos. A., Philadelphia, Pa.

Power—Belting. Rhoads & Sons., J. E., Wilmington, Del.

Precipitron—Electrostatic dust collectors. Pangborn Corp., Hagerstown, Md.

Precipitron—Dust collectors. Westinghouse Electric & Mfg. Co., Mansfield, O.

Precision — Oil burners. Kleen - Heet, Inc., Chicago, Ill.

Premier—Boilers. Combustion Engineering Co., Inc., New York, N. Y.

Premier — Boilers, heaters. National Radiator Corp., Johnstown, Pa.

Premier — Welding rod, electrodes. American Steel & Wire Co., Cleveland, O.

Presstico—Insulation. Presstite Engineering Co., St. Louis, Mo.

Prest-O-Lite—Leak detectors, torches. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Prest-O-Weld—Welding and cutting apparatus. Linde Air Products Co. The, New York, N. Y.

Probestos—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Protectomotor — Air filters. Staynew Filter Corp., Rochester, N. Y.

Protectorelay — Relays. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Protectovent—Window ventilator and filter units. Staynew Filter Corp., Rochester, N. Y.

Pulling—Pumps. Columbus Steam Pump Works Co., Columbus, O.

Pulverzone—Stokers. American Coal Burner Co., Chicago, Ill.

Punkah—Louvers and shutters. White Co., Kelvin & Wilfred B., Boston, Mass.

Purox—Electrodes, welding and cutting apparatus. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Pyrex—Glass pipe. Corning Glass Wks., Corning, N. Y.

Pyro—Thermometers. Pyrometer Instrument Co., New York, N. Y.

Pyrofelt—Covering. Mineral Felt Co., Toledo, O.

Pyroment—Cement. Keasbey & Mattison Co., Ambler, Pa.

Q

Q. F. R.—Pipe, tubing. Wheatland Tube Co., Philadelphia, Pa.

Quality—Unit heaters, radiation, cooling surface. Young Radiator Co., Racine, Wis.

Quasi-Arc—Electrodes, welding rod. Keasbey & Mattison Co., Ambler, Pa.

Quilt—Insulation. Cabot, Inc., Samuel, Boston, Mass.

Quintuplet—Regulators. Maid-O-Mist, Inc., Chicago, Ill.

R

R & G—Grilles, registers. Register & Grille Mfg. Co., Brooklyn, N. Y.

R-K—Regulators. Ruggles-Klingeman Mfg. Co., Salem, Mass.

R. P & C.—Valves. Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.

R-U-F—Fans. Reed Unit-Fans, Inc., New Orleans, La.

Radi-Ion—Ionization apparatus, ozone apparatus. Montgomery Bros., San Francisco, Cal.

Rainbow—Humidifiers. Sheer Co., H. M., Quincy, Ill.

Rainbow Mist—Nozzles. National Air Conditioning & Engineering Corp., Kansas City, Mo.

Raydiant—Radiation. Weil-McLain Co., Chicago, Ill.

Reco—Condensers, exchangers, heaters, preheaters, tanks. Richmond Engineering Co., Richmond, Va.

Record-O-Stat—Recorder-Controllers. Johnson Service Co., Milwaukee, Wis.

Red Band—Motors. Howell Electric Motors Co., Howell, Mich.

Red Diamond—Conduit, covering. American District Steam Co., North Tonawanda, N. Y.

Red Dome—Heaters. Smith Co., H. B., Westfield, Mass.

Red Flash—Traps. Ellis Drier Co., Chicago, Ill.

Red Head—Tongs. Billings & Spencer Co., Hartford, Conn.

Red Head—Traps. Ellis Drier Co., Chicago, Ill.

Red-Reading-Mercury—Thermometers. Palmer Co., Cincinnati (Norwood), O.

Redsquare—Boilers. Utica Radiator Corp., Utica, N. Y.

Red Top—Humidistats, thermostats. H-B Instrument Co., Philadelphia, Pa.

Reed-Jenkins—Valves. Reed Steam Equipment Co., Bridgeport, Conn.

Reed-Warren—Pumps. Reed Steam Equipment Co., Bridgeport, Conn.

Reg-Gril-Co—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Relay—Filters. Ripley Co., W. R., Tacoma, Wash.

Reliance—Packing. Chicago Belting Co., Chicago, Ill.

Reliance—Regulators. General Controls Co., San Francisco, Cal.

Remco—Bases. Manley Products Corp., York, Pa.

Remote Re-Adjustable—Thermostats. Johnson Service Co. Milwaukee, Wis.

Renewo—Valve,s. Lunkenheimer Co. Cincinnati, O.

Renu-Vent—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Rex—Cement. Keasbey Co., Robert A., New York, N. Y.

Rex-AC—Pillow Blocks, fans. Air Controls, Inc., Cleveland, O.

Rex-Airate—Roof Ventilators, blower wheels. Air Controls, Inc., Cleveland, O.

Rexoil—Boilers, burners, furnaces, heaters. Reif-Rexoil, Inc., Buffalo, N. Y.

Rexvane—Fans, unit heaters. Sturtevant Co., B. F., Boston, Mass.

Rex-Weld—Hose. Chicago Metal Hose Corp., Maywood, Ill.

Richvar—Boilers, radiation. Richmond Radiator Co., Gas Products Div., Uniontown, Pa.

Ridgid—Pipe machines, wrenches, cutters, vises. Ridge Tool Co., Elyria, O.

Rifco—Unions. Rhode Island Fittings Co., Hillsgrove, R. I.

Rihco—Humidifiers. Rhode Island Humidifier & Ventilating Co., Boston, Mass.

Rockaway—Regulators, valves. Kieley & Mueller, Inc., New York, N. Y.

Rocktex—Insulation. Carey Co., Philip, Lockland, Cincinnati, O.

Rocop—Heaters. Rome-Turney Radiator Co., Rome, N. Y.

Roofvane—Ventilators. Sturtevant Co., B. F., Boston, Mass.

Roof-Vent—Ventilators. Reed Unit-Fans, Inc., New Orleans, La.

Root—Fittings, pipe. Abendroth & Root Mfg. Co., Newburgh, N. Y.

Ross-Harrison—Heaters. Ross Engineering Corp., J. O., New York, N. Y.

Rotameter—Flow meters. Schutte & Koerting Co., Philadelphia, Pa.

Roto Blast—Furnaces. Moncrief Furnace Co., Atlanta, Ga.

Roto-Clone—Dust collectors. American Air Filter Co., Inc., Louisville, Ky.

Rotojet—Spray nozzles. Binks Mfg. Co., Chicago, Ill.

Royal—Boilers, furnaces, water heaters. Hart & Crouse Co., Inc., Utica, N. Y.

Royal "Oriole"—Radiation. Hart & Crouse Co., Inc., Utica, N. Y.

Ruberoid-Watson—Cement, covering. Ruberoid Co., New York, N. Y.

Rubyfluid—Solder. Ruby Chemical Co., Columbus, O.

Runwell—Packing. Greene, Tweed & Co., New York, N. Y.

Rynn—Burners, valves. R-S Products Corp., Philadelphia, Pa.

S

SF—Welding rod, welding and cutting apparatus. Sight Feed Generator Co., Richmond, Ind.

S & P—Burners, governors, preheaters, regulators, strainers, valves. Staples & Pfeiffer, Ltd., San Francisco, Cal.

St. John—Condensation meters. American District Steam Co., North Tonawanda, N. Y.

Sal-Mo—Cement, covering, insulation, packing, pipe. Sall Mountain Co., Chicago, Ill.

Saunders—Pipe cutters. Erie Tool Works, Erie, Pa.

Scobronze—Welding rod. Scovill Mfg. Co., Waterbury, Conn.

Scru-peller—Ejectors. Chicago Pump Co., Chicago, Ill.

Sea Lion—Packing. Chicago Belting Co., Chicago, Ill.

Sealkote—Cement. Keasbey & Mattison Co., Ambler, Pa.

Seismo-Dampers—Bases. Korfund Co., Long Island City, N. Y.

Selfvulc—Cement, covering, insulation. Self-Vulcanizing Rubber Co., Inc., Chicago, Ill.

Sensitrol—Relays. Weston Electrical Instrument Corp., Newark, N. J.

Series 3—Heaters. Fedders Mfg. Co., Inc., Buffalo, N. Y.

Sesure—Gages. Yarnall-Waring Co., Philadelphia, Pa.

Shawco—Bends, joints, headers. Shaw Co., Benjamin F., Wilmington, Del.

Shield-Arc—Electrodes, arc welders. Lincoln Electric Co., Cleveland, O.

Shield Arc Eighty Five—Electrodes. Lincoln Electric Co., Cleveland, O.

Shield Arc One Hundred—Electrodes. Lincoln Electric Co., Cleveland, O.

Silcrome—Sheets. Ludlum Steel Co., Watervliet, N. Y.

Silent Air—Fans. Belanger Fan & Blower Co., Detroit, Mich.

Silentaire—Window ventilator units. Truscon Steel Co., Youngstown, O.

Silent Floating—Bases. Buffalo Forge Co., Buffalo, N. Y.

Silentile—Insulation. Mineral Felt Co., Toledo, O.

Silentvane—Fans. Sturtevant Co., B. F., Boston, Mass.

Sil-Fos—Solder. Handy & Harman, New York, N. Y.

Silowatt—Valves. Electrimatic Corp., Chicago, Ill.

Silverlink—Chain drives. Link-Belt Co., Chicago, Ill.

Silverseal—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Silverstreak—Chain drive. Link-Belt Co., Chicago, Ill.

Silvertop—Traps. V. D. Anderson Co., Cleveland, O.

Sirocco—Blowers, dust collectors, fans, grilles, unit air conditioners, unit air coolers, unit air humidifiers, air washers. American Blower Corp., Detroit, Mich.

Slaset—Valves. Lukenheimer Co., Cincinnati, O.

Slip-lock—Wheels. Viking Air Conditioning Corp., Cleveland, O.

Smoot—Regulators. Republic Flow Meters Co., Chicago, Ill.

Sodrin—Boiler and radiator sealing compound. Dole Valve Co., Chicago, Ill.

Solder Seal—Compounds. Radiator Specialty Co., Charlotte, N. C.

Sovereign—Packing. Darcoid Co., Inc., New York, N. Y.

Special '98—Regulators, valves. Kieley & Mueller, Inc., New York, N. Y.

Speedarc—Electrodes. Universal Power Corp., Cleveland, O.

Speed Heater—Unit heaters. Sturtevant Co., B. F., Boston, Mass.

Spider Web—Air filters. Wilson & Co., Chicago, Ill.

Spirodome—Spray nozzles. Cooling Tower Co., Inc., New York, N. Y.

Spirovane—Fans. Western Blower Co., Seattle, Wash.

Sporlan—Valves. Spoehrer-Lange Co., St. Louis, Mo.

Spraco—Nozzles, separators, strainers, washers. Spray Engineering Co., Somerville, Mass.

Spra-Rite—Nozzles. Binks Mfg. Co., Chicago, Ill.

Stabilflo—Valves. Foxboro Co., Foxboro, Mass.

Stable-Arc—Electrodes, arc welders. Lincoln Electric Co., Cleveland, O.

Stainarc—Electrodes. Universal Power Corp., Cleveland, O.

Stainless—Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Stainweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Stainweld A—Electrodes. Lincoln Electric Co., Cleveland, O.

Stainweld B—Electrodes. Lincoln Electric Co., Cleveland, O.

Standard—Traps. Kieley & Mueller, Inc., New York, N. Y.

Star—Ventilators. Merchant & Evans Co., Philadelphia, Pa.

Steechan—Blinds. Standard Products Co., Detroit, Mich.

Sterlco—Circulators, controls, eliminators, floats, gages, pumps, strainers, heating systems, traps, valves. Sterling Engineering Co., Milwaukee, Wis.

Stictite—Cement. Refractory & Insulation Corp., New York, N. Y.

Stoker-King — Stokers. Stokers, Inc., Detroit, Mich.

Stokol—Stokers. Schwitzer - Cummins Co., Indianapolis, Ind.

Stowe—Stokers. Johnston & Jennings Co., Cleveland, O.

Strait-Line — Bases. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Streamaire—Unit heaters, radiation, cooling surface. Young Radiator Co., Racine, Wis.

Streamline—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Streamline—Ducts. Jacobs Co., B. & J., Cincinnati, O.

Stronghold—Belting. Rhoads & Sons, J. E., Wilmington, Del.

Stud-Pak—Insulation. United States Mineral Wool Co., Chicago, Ill.

Sullarc — Electrodes. Universal Power Corp., Cleveland, O.

Summer-Winter—Thermostats. Johnson Service Co., Milwaukee, Wis.

Super Cold Fin — Cooling surface. Rempe Co., Chicago, Ill.

Super-deLavaud—Pipe. U. S. Pipe & Foundry Co., Burlington, N. J.

Superector—Wrenches. Williams & Co., J. H., New York, N. Y.

Superheat—Packing. Keasbey & Mattison Co., Ambler, Pa.

Superior—Wrenches. Williams & Co., J. H., New York, N. Y.

Superjustable—Wrenches. Williams & Co., J. H., New York, N. Y.

Superrench—Wrenches. Williams & Co., J. H., New York, N. Y.

Super-S—Gages. Klingerit, Inc., New York, N. Y.

Super Silvertop—Traps. V. D. Anderson Co., Cleveland, O.

Supersocket—Wrenches. Williams & Co., J. H., New York, N. Y.

Super-type—Unit heaters. Autovent Fan & Blower Co., Chicago, Ill.

Sure Seal—Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Surevent—Valves. Gorton Heating Corp., Cranford, N. J.

Surlock—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Sylphon—Traps. Webster & Co., Warren, Camden, N., J.

Synchro-Meter—Meters. Bailey Meter Co., Cleveland, O.

Synchrotax — Thermostats. Foxboro Co., Foxboro, Mass.

Syncretizer—Unit ventilators. Nesbitt, Inc., John J. & Buckeye Blower Co., Philadelphia, Pa.

Syncromaster—Pressure regulators. Mason-Neilan Regulator Co., Boston, Mass.

T

TE—Compressors. Janette Mfg. Co., Chicago, Ill.

T.T.—Smoke guns. Hill, E. Vernon, Chicago, Ill.

Tabasco — Water heaters. Kewanee Boiler Corp., Kewanee, Ill.

Tag—Humidistats, hygrometers, manometers, meters, psychrometers, recorders, regulators, thermometers, traps, valves. Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.

Tank-O-Meter—Gages. Uehling Instrument Co., Paterson, N. J.

Tannate—Belting, packing. Rhoads & Sons, J. E., Wilmington, Del.

Tanseal — Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Tatroweld—Welders. Tatro Bros., Inc., Decorah, Ia.

Teksag Colloid—Boiler compounds. American Teksag Products Co., Inc., Mount Vernon, N. Y.

Televisor—Gages. Schutte & Koerting Co., Philadelphia, Pa.

Teltru—Anemometers, gages. Hill, E. Vernon, Chicago, Ill.

Tem-Clock (Electric) — Time switches. Penn Electric Switch Co., Goshen, Ind.

Temlok—Insulation. Armstrong Cork Products Co., Lancaster, Pa.

Texaco—Lubricating oil. Texas Co., New York, N. Y.

Texrope — V-belt drives. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Textype—Unit heaters. Modine Mfg. Co., Racine, Wis.

Thermair—Furnaces, heaters. New York Blower Co., Chicago, Ill.

Thermaire — Heaters. Schoedinger, F. O., Columbus, O.

Thermidaire—Boilers, fans, furnaces, grilles, heaters, humidifiers, unit air conditioners. Campbell Heating Co., E. K., Kansas City, Mo.

Thermo—Expansion valves. Alco Valve Co., Inc., St. Louis, Mo.

Thermofin — Radiation. Grinnell Co., Inc., Providence, R. I.

Thermoflex — Strainers, heating systems, traps, valves. Cashin Co., W. D., Boston, Mass.

Thermoguide — Thermometers. Taylor Instrument Companies, Rochester, N. Y.

Thermolier — Unit heaters, unit air coolers. Grinnell Co., Inc., Providence, R. I.

Therm-o-tile—Conduit. Porter & Co., Inc., H. W., Newark, N. J.

Thermotrol—Valves. Sterling Engineering Co., Milwaukee, Wis.

Thermovent—Unit ventilators. Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.

Thredolets—Fittings. Bonney Forge & Tool Wks., Allentown, Pa.

Three Point—Valves. Webster & Co., Warren, Camden, N. J.

Thrift—Water heaters. Surface Combustion Corp., Toledo, O.

Throway—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Ticone—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Tighton—Unions. Standard Union Co., New York, N. Y.

Timercoid — Time switches. Mercoid Corp., Chicago, Ill.

Timetrol (Manual) — Time switches. Penn Electric Switch Co., Goshen, Ind.

Tiny—Traps. Nason Co., Detroit, Mich.

Tiscot—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Titan—Traps. Nason Co., Detroit, Mich.

Tobin Bronze—Welding rod. American Brass Co., Waterbury, Conn.

Tom Thumb—Pipe machines. Oster Mfg. Co., Cleveland, O.

Toncan—Pipe, sheets, tubing. Republic Steel Corp., Cleveland, O.

Toncanarc — Electrodes. Universal Power Corp., Cleveland, O.

Torrid-Aire—Heaters. U. S. Air Conditioning Corp., Minneapolis, Minn.

Transite—Pipe. Johns-Manville, New York, N. Y.

Transitorq—Speed reducers. New Departure Div., General Motors Corp., Bristol, Conn.

Trem-Bar—Insulation. United States Gypsum Co., Chicago, Ill.

Trimo—Cutters, vises, wrenches. Trimont Mfg. Co., Boston, Mass.

Triple Duty—Boilers. Bass Foundry & Machine Co., Ft. Wayne, Ind.

Tri-Sil—Dampers, registers. Tuttle & Bailey, Inc., New Britain, Conn.

Tritrol — Regulators, switches. Marsh Corp., Jas. P., Chicago, Ill.

Tritrol—Heating systems. Marsh Tritrol Co., Chicago, Ill.

Triumph—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Triumph—Pipe line filters. Adams Co., R. P., Buffalo, N. Y.

Trojan—Boilers. Burnham Boiler Corp., Irvington, N. Y.

Truflex—Bi-metals. General Plate Co., Attleboro, Mass.

Try-Me—Regulators, strainers, valves. Tryco Products, Inc., Westfield, Mass.

Tubejet—Pumps. Wheeler Mfg. Co., C. H., Philadelphia, Pa.

Turbo—Air washers, dehumidifiers, spray nozzles. Bayley Blower Co., Milwaukee, Wis.

Turbo-Aquatherm — Water heaters. Dahlquist Mfg. Co., Inc., Boston, Mass.

Turbo Vane—Fans and blowers. B. F. Sturtevant Co., Boston, Mass.

Turret—Pumps. Yeomans Bros. Co., Chicago, Ill.

20th Century—Bearings. Roller Bearing Co. of America, Trenton, N. J.

Tymit—Switches. Tork Clock Co., Inc., Mt. Vernon, N. Y.

U

UAC—Unit air conditioners. Burnham Boiler Corp., Irvington, N. Y.

U. F. S.—Clamps. Grinnell Co., Inc., Providence, R. I.

U. S.—Unions. United Superior Union Co., Inc., Brooklyn, N. Y.

U. S. Airco—Air conditioning equipment. U. S. Air Conditioning Corp., Minneapolis, Minn.

USS—Pipe, tubing. National Tube Co., Pittsburgh, Pa.

U-Loy—Sheets. Republic Steel Corp., Cleveland, O.

Ultralite—Insulation. Insulite Co., Minneapolis, Minn.

Uniblade—Fans. Autovent Fan & Blower Co., Chicago, Ill.

Unicool—Humidifiers, unit air conditioners, unit air coolers, unit air humidifiers, air washers. Betz Unit Air Cooler Co., Kansas City, Mo.

Uni-fin—Grilles, registers. Barber-Colman Co., Rockford, Ill.

Uni-flo—Grilles. Barber-Colman Co., Rockford, Ill.

Unitaire—Unit air conditioners. Westinghouse Electric & Mfg. Co., Mansfield, O.

Unitherm—Unit heaters. Clarage Fan Co., Kalamazoo, Mich.

Universal—Air filters. Hugo Mfg. Co., West Duluth, Minn.

Universal—Hygrometers, psychrometers. Hill, E. Vernon, Chicago, Ill.

Upson—Bolts. Republic Steel Corp., Cleveland, O.

Utica—Radiation. International Heater Co., Utica, N. Y.

Utility—Packing. Keasbey & Mattison Co., Ambler, Pa.

V

Vacu-Draft — Blowers. Muncie Gear Wks., Inc., Muncie, Ind.

Valcalox—Damper regulators. Young Regulator Co., Cleveland, O.

Vaughan—Meters. Spray Engineering Co., Somerville, Mass.

Velvet—Cement. Keasbey & Mattison Co., Ambler, Pa.

Vento — Heating surface. American Radiator Co., New York, N. Y.

Vent-Rite—Air valves. Anderson Products, Inc., Cambridge, Mass.

Vent-Rite Balancer—Valves. Anderson Products, Inc., Cambridge, Mass.

Ventura—Fans. American Blower Corp., Detroit, Mich.

Venturafin — Unit heaters. American Blower Corp., Detroit, Mich.

Vercel—Covering. Eagle-Picher Lead Co., Cincinnati, O.

Vibracork — Bases. Armstrong Cork Products Co., Lancaster, Pa.

Vibro-Dampers — Bases. Korfund Co., Long Island City, N. Y.

Vibro Insulators—Bases. Goodrich Co., B. F., Akron, O.

Victor—Welding and cutting apparatus. Sight Feed Generator Co., Richmond, Ind.

Victory — Burners. Caloroil Burner Corp., Hartford, Conn.

Vik-Air—Unit air conditioners. Viking Air Conditioning Corp., Cleveland, O.

Vitalloy—Wrenches. Billings & Spencer Co., Hartford, Conn.

Vistand—Pipe vises. Armstrong Mfg. Co., Bridgeport, Conn.

V-Meth-L — Refrigerant. Virginia Smelting Co., West Norfolk, Va.

Vulcalock—Fittings, pipe, valves. Goodrich Co., B. F., Akron, O.

Vulcan—Benders, stands, tongs, vises. Williams & Co., J. H., New York, N. Y.

Vulcan—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Vulcan Boll-Weevil — Tongs. Williams & Co., J. H., New York, N. Y.

Vulcan Boll-Weevil Zephyr — Tongs. Williams & Co., J. H., New York, N. Y.

Vulcan Superior—Tongs, vises. Williams & Co., J. H., New York, N. Y.

Vulcan Supertong—Tongs. Williams & Co., J. H., New York, N. Y.

Vulco—Drives. Gates Rubber Co., Denver, Col.

W

WEACO—Heaters. Warren Electric Appliance Co., Warren, Pa.

WHS—Blocks, couplings, drives, reducers. Smith, Inc., Winfield H., Springville, N. Y.

W J—Compounds. Radiator Specialty Co., Charlotte, N. C.

W. & Mc.D.—Valves. Watson & McDaniel Co., Philadelphia, Pa.

Walco—Wrenches. Walworth Co., New York, N. Y.

Walseal—Fittings, valves. Walworth Co., New York, N. Y.

Waltham—Burners. d'Este Co., Julian, Charlestown, Mass.

Warco—Gages, valves. Russell & Co., W. A., New York, N. Y.

Water-Boy—Feeders, unit air humidifiers. Maid-O-Mist, Inc., Chicago, Ill.

Waterfilm—Boilers. Koven & Bro., L. O., Jersey City, N. J.

Watson—Governors, regulators, valves. Watson & McDaniel Co., Philadelphia, Pa.

Way "Loctor"—Access panels. Walsh Spencer Co., Boston, Mass.

Wearweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Weathermaker—Unit air conditioners. Carrier Corp., Syracuse, N. Y.

Weatherseal—Rock wool insulation. Sprayo-Flake Co., Chicago, Ill.

Weatherwood—Insulation. United States Gypsum Co., Chicago, Ill.

Webster—Air washers, nozzles. Strandwitz & Co., Inc., Camden, N. J.

Weldells—Welding fittings. Taylor Forge & Pipe Works, Chicago, Ill.

Weldfast—Welding rod. Revere Copper & Brass, Inc., New York, N. Y.

Weldolets—Fittings. Bonney Forge & Tool Works, Allentown, Pa.

Westotherm — Thermometers. Weston Electrical Instrument Corp., Newark, N. J.

Weyher—Circulators, heaters. Automatic Stoker Corp., Milwaukee, Wis.

White — Circulators, valves. Hoosick Engineering Co., Inc., Hoosick Falls, N. Y.

Wichita—Condensers. Motor Equipment Co., Wichita, Kans.

Wilson—Arc welders. Air Reduction Sales Co., New York, N. Y.

Windowstat — Condensation control. Friez & Sons, Inc., Julien P., Baltimore, Md.

Wind-O-Vent — Window ventilator and filter units. Reed Unit-Fans, Inc., New Orleans, La.

Winner—Registers. Auer Register Co., Cleveland, O.

Winter Chaser—Unit air humidifiers. Campbell Heating Co., Des Moines, Ia.

Wintermaster—Unit air humidifiers. International Boiler Works Co., East Stroudsburg, Pa.

Witch—Hangers, protectors. Carpenter & Paterson, Inc., East Boston, Mass.

Wolverine—Collectors, fans, ventilators, washers. Belanger Fan & Blower Co., Detroit, Mich.

Wonder—Benders. American Pipe Bending Machine Co., Inc., Boston, Mass.

X

Xit—Ventilators. Iona Ventilator Co., Inc., Philadelphia, Pa.

Y

Yager—Solder. Benson Co., Inc., Alex R., Hudson, N. Y.

Yarway — Expansion joints, nozzles, traps, valves. Yarnall-Waring Co., Philadelphia, Pa.

York-Lalor—Valves. York Oil Burner Co., Inc., York, Pa.

Z

Zephyr—Unit air conditioners. Apex Rotarex Corp., Cleveland, O.

Zerozone — Refrigerating compressors. Copeland Refrigeration Corp., Mt. Clemens, Mich.

DIRECTORY SECTION
HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS
PART 3—MANUFACTURERS' ADDRESSES

A

Abendroth & Root Mfg. Co., Newburgh, N. Y.
Accurate Mfg. Works, 2432 Milwaukee Ave., Chicago, Ill.
Ace Engineering Co., 1735 W. 31st St., Chicago, Ill.
Acer & Whedon, Medina, N. Y.
Acheson Mfg. Co., Braddock P. O., Rankin, Pa.
Acme Asbestos Covering & Flooring Co., 218 N. Elizabeth St., Chicago, Ill.
Acme Heating & Ventilating Co., Inc., 4224 Lowe Ave., Chicago, Ill.
Acme Industries, Inc., Cor. Calhoun & Ingham Sts., Jackson, Mich.
Acme Tin Plate & Roofing Supply Co., 10th and York Sts., Philadelphia, Pa.
Acorn Refining Co., 8001 Franklin Ave., Cleveland, O.
Adam Electric Co., Frank, 3650 Windsor St., St. Louis, Mo.
Adams Mfg. Co., J. D., 217 S. Belmont Ave., Indianapolis, Ind.
Adams Co., R. P., 220 Delaware Ave., Buffalo, N. Y.
Adams Engineering Co., 2607 S. Wentworth Ave., Chicago, Ill.
Advance Fan & Blower Co., 3428 Bagley, Detroit, Mich.
Advance Mfg. Co., Inc., 350 N. 26th St., Louisville, Ky.
Advanced Refrigerating Systems Co., 33rd and Arch Sts., Philadelphia, Pa.
Aeco Packing Products Co., 215 W. Illinois St., Chicago, Ill.
Aeolus Dickinson Co., 3320 S. Artesian Ave., Chicago, Ill.
●Aerofin Corp., 410 S. Geddes St., Syracuse, N. Y.
Aerovent Fan Co., 710 E. Ash St., Piqua, O.
Ahlberg Bearing Co., 3025 W. 47th St., Chicago, Ill.
●Air Conditioning Products Co., 1230 18th St., Detroit, Mich.
Air Controls, Inc., 9205 Detroit Ave., Cleveland, O.
Aircraft Mfg. Co., 418 E. First St., Dayton, O.
Air Devices Corp., 70 Britannia St., Meriden, Conn.
Airgard Mfg. Co., 609 N. La Salle St., Chicago, Ill.
Airmaster Corp., 140 S. Dearborn St., Chicago, Ill.
●Air-Maze Corp., 812 Huron Rd., Cleveland, O.
●Airo Supply Co., 2726 N. Ashland Ave., Chicago, Ill.
Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y.
Airtemp, Inc., Leo St., Dayton, O.
●Airtherm Mfg. Co., 1474 S. Vandeventer Ave., St. Louis, Mo.
Ajax Flexible Coupling Co., Westfield, N. Y.
Akrat Ventilator Co., 1717 Carroll Ave., Chicago, Ill.
Akron Metallic Gasket Co., 155 N. Union, Akron, O.
Akwa Heaters, Inc., 101 Park Ave., New York, N. Y.
Alabama Pipe Co., Anniston, Ala.
Alco Products, Inc., 220 E. 42nd St., New York, N. Y.
●Alco Valve Co., Inc., 2628 Big Bend Blvd., St. Louis, Mo.
Aldrich Pump Co., 4 Pine St., Allentown, Pa.
Alexander Bros., 406 N. 3rd, Philadelphia, Pa.
Alfol Insulation Co., Inc., 155 E. 44th St., New York, N. Y.
Allegheny Steel Co., Brackenridge, Pa.
Allen Billmyre Corp., 136 Water St., South Norwalk, Conn.
●Allen-Bradley Co., 1335 S. First St., Milwaukee, Wis.
Allen Corp., 9751 Erwin Ave., Detroit, Mich.
Allen-Sherman-Hoff Co., 225 S. 15th St., Philadelphia, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Allis Co., Louis, 427 E. Stewart St., Milwaukee, Wis.
All Metal Weatherstrip Co., 229 W. Illinois St., Chicago, Ill.
Alloy Steel Products Co., 1000 W. Elizabeth Ave., Linden, N. J.
Allpax Co., Inc., Mamaroneck, N. Y.
Alter-Arc Mfg. Co., 209 B St., Lawton, Okla.
Alton Mineral Wool Co., P. O. Box 268, Alton, Ill.
Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh, Pa.
American Air Conditioning Corp., P. O. Box 29, Sebastopol, Calif.
●American Air Filter Co., Inc., 107 Central Ave., Louisville, Ky.
●American Blower Corp., 6000 Russell St., Detroit, Mich.
●American Brass Co., 414 Meadow St., Waterbury, Conn.
American Car & Foundry Co., 30 Church St., New York, N. Y.
American Cast Iron Pipe Co., 2930 N. 16th St., Birmingham, Ala.
American Chain & Cable Co., Inc., Page Steel & Wire Div., 929 Connecticut Ave., Bridgeport, Conn.
American Coal Burner Co., 155 E. Superior St., Chicago, Ill.
American Coolair Corp., 3604 Mayflower St., Jacksonville, Fla.
American Cooling Tower Co., 2710 McGee St., Kansas City, Mo.
●American District Steam Co., North Tonawanda, N. Y.
American Flange & Mfg. Co., Inc., Radio City, New York, N. Y.
American Flexible Coupling Co., 1801 Pittsburgh Ave., Erie, Pa.
American Foundry Equipment Co., 619 Byrkit St., Mishawaka, Ind.
American Foundry & Furnace Co., Washington St. at McClun, Bloomington, Ill.
American Gas Products Co., 40 W. 40th St., New York, N. Y.
●American Hair & Felt Co., 1820 Merchandise Mart, Chicago, Ill.
American Hard Rubber Co., 11 Mercer St., New York, N. Y.
American Hydrozone Co., Inc., 10 E. 40th St., New York, N. Y.
American Injector Co., 1481-14th St., Detroit, Mich.
American Instrument Co., Silver Spring, Md.
American-Larson Ventilating Co., 1004 Keystone Bank Bldg., Pittsburgh, Pa.
American Locomotive Co., Diesel Engine Div., Auburn, N. Y.
American Manganese Bronze Co., Rhawn & Hegerman Sts., Philadelphia, Pa.
●American-Marsh Pumps, Inc., 60 Capital Ave., N. E., Battle Creek, Mich.
●American Metal Hose Branch, American Brass Co., 67 Jewelry St., Waterbury, Conn.
American Meter Co., Inc., 105 W. 40th St., New York, N. Y.
American Moistening Co., 260 W. Exchange St., Providence, R. I.
American Nickeloid Co., Box 127, Peru, Ill.
American Pipe Bending Machine Co., Inc., 37 Pearl St., Boston, Mass.
American Pipe Tool Co., 4533 W. Harrison St., Chicago, Ill.
American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa.
American Radiator Co., 40 W. 40th St., New York, N. Y.
●American Rolling Mill Co., 703 Curtis St., Middletown, O.
American Solder & Flux Co., Wayne Ave., and Berkley St., Philadelphia, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
American Teksag Products Co., Inc., 395 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
American Thermometer Co., 2907 Clark Ave., St. Louis, Mo.
American Warming & Ventilating Co., 1017-1021 Summit St., Toledo, O.
American Well Wks., 100 N. Broadway, Aurora, Ill.
American Zinc Products Co., Greencastle, Ind.
Ames Co., W. R., 150 Hooper St., San Francisco, Cal.
Ames Iron Works, Division of Pierce Butler Radiator Corp., Oswego, N. Y.
Amirton Co., 60 E. 42nd St., New York, N. Y.
Anchor Packing Co., 401 N. Broad St., Philadelphia, Pa.
Anchor Stove & Range Co., Third & Culbertson Sts., New Albany, Ind.
●Anderson Co., V. D., 1949 W. 96th St., Cleveland, O.
Anderson Engine & Foundry Co., Anderson, Ind.
Anderson Products, Inc., 17 Tudor St., Cambridge, Mass.
Anderson Rotary Pump Co., 120 Liberty St., New York, N. Y.
Andrews Bradshaw Co., Blawnox, Pittsburgh, Pa.
Andrews Lead Co., 26-36 Greenpoint Ave., Long Island City, N. Y.
●Anemostat Corp. of America, 10 E. 39th St., New York, N. Y.
Anetsberger Bros., 3505 Elston Ave., Chicago, Ill.
●**Annis, Emmet F., 1515 Gardena St., Glendale, Cal.**
Ansul Chemical Co., Marinette, Wis.
Antaciron, Inc., Tillman St., Raritan, N. J.
Apex Rotarex Corp., Cleveland, O.
Apollo Steel Co., 609 Warren Ave., Apollo, Pa.
Aquatic Chemical Laboratories, Inc., 118 E. 28th St., New York, N. Y.
Arex Co., 333 N. Michigan Ave., Chicago, Ill.
Armour Ammonia Works, 1355 W. 31st St., Chicago, Ill.
Armstrong-Blum Mfg. Co., 5700 Bloomingdale Rd., Chicago, Ill.
Armstrong Bros. Tool Co., 317-357 N. Francisco Ave., Chicago, Ill.
●Armstrong Cork Products Co., 994 Concord St., Lancaster, Pa.
●Armstrong Machine Wks., 874 Maple St., Three Rivers, Mich.
Armstrong Mfg. Co., 303 Knowlton St., Bridgeport, Conn.
Arrow-Hart & Hegeman Elect. Co., 103 Hawthorn St., Hartford, Conn.
Ashton Valve Co., 161-1st St., Cambridge, Mass.
Atchison Revolving Door Co., Independence, Kans.
Athey Co., 1923 S. Calumet Ave., Chicago, Ill.

● Advertisement in this issue. See Index to Advertisers, page 232.

Athol Machine & Foundry Co., 621-631 S. Kolmar Ave., Chicago, Il.
Atlas Valve Co., Inc., 282 South St., Newark, N. J.
Auburn Foundry, Inc., Stoker Div., Auburn, Ind.
●Auditorium Conditioning Corp., 17 E. 42nd St., New York, N. Y.
●Auer Register Co., 3608 Payne Ave., Cleveland, O.
Aurora Pump Co., N. Loucke St., Aurora, Ill.
Austin-Mason Co., 15 Park Row, New York, N. Y.
Autoforce Ventilating System, 53 Devonshire St., Boston,
●Automatic Products Co., 2450 N. 32nd St., Milwaukee, Wis.
Automatic Stoker Corp., 3925 N. Port Washington Ave., Milwaukee, Wis.
Automatic Switch Co., 154 Grand St., New York, N. Y.
Automatic Temperature Control Co., Inc., 34 E. Logan St. Philadelphia Pa.
●Autovent Fan & Blower Co., 1805-25 N. Kostner Ave., Chicago, Ill.

B

Babcock & Wilcox Co., 85 Liberty St., New York, N. Y.
Bacharach Industrial Instrument Co., 7000 Bennett St., Pittsburgh, Pa.
Bache & Co., Semon, Greenwich & Morton Sts., New York, N. Y.
Badger & Sons Co., E. B., 75 Pitts St., Boston, Mass.
Badger Fire Extinguisher Co., 31 St. James Ave., Boston, Mass.
Bahnson Co., R. J. Reynolds Bldg., Winston-Salem, N. C.
Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, O.
●Baker Ice Machine Co., Inc., 1509 Evans St., Omaha, Nebr.
●Baldor Electric Co., 4353 Duncan Ave., St. Louis, Mo.
Ballantyne Co., 219 N. 16th St., Omaha, Nebr.
Balloffet Diamond Wire Dies Co., 45-51 Adams St., Guttenberg, N. J.
Baltimore Tube Co., Div. Revere Copper and Brass, Inc., 1301 Wicomico St., Baltimore, Md.
Barber Co., Inc., 16th & Arch Sts., Insurance Co. of North America Bldg., Philadelphia, Pa.
●Barber-Colman Co., 225 Loomis St., Rockford, Ill.
Barber Gas Burner Co., 3704 Superior Ave., Cleveland, O.
Barco Mfg. Co., 1801 Winnemac Ave., Chicago, Ill.
Barnes & Jones, Inc., 128 Brookside Ave., Jamaica Plain, Boston, Mass.
Barnes Tool Co., 150 Brewery St., New Haven, Conn.
Barrett, Haentjens & Co., Hazelton, Pa.
Barrett Machine Co., 912-916 Behan St., N. S., Pittsburgh, Pa.
Bartlett Hayward Co., 200 Scott St., Baltimore, Md.
Bass Foundry & Machine Co., 1602-1734 Hanna St., Ft. Wayne, Ind.
Bastian-Blessing Co., 240 E. Ontario St., Chicago, Ill.
Bausch & Lomb Optical Co., 635 St. Paul St., Rochester, N. Y.
Bayer Co., 4050 Park Ave., St. Louis, Mo.
Bayley Blower Co., 1817 S. 66th St., Milwaukee, Wis.
Beach-Russ Co., 60A Church St., New York, N. Y.
Beacon-Morris Corp., 702 Beacon St., Boston, Mass.
Bearings Co. of America, 501 Harrisburg Ave., Lancaster, Pa.
Beaton & Cadwell Mfg. Co., 185 Main St., New Britain, Conn
Beaton & Corbin Mfg. Co., Southington, Conn.
●Beaver Pipe Tools, Inc., Keeney Ave., Warren, O.
Belanger Fan & Blower Co., 1230 18th St., Detroit, Mich.
Belco Exhaust Fan Mfg. Co., 3810 Olive St., St. Louis, Mo.
Belfield Co., H., 435 N. Broad St., Philadelphia, Pa.
Belknap Mfg. Co., 800 Union Ave., Bridgeport, Conn.
●Bell & Gossett Co., 3000 Wallace St., Chicago, Ill.
Belmont Packing & Rubber Co., Butler & Sepviva Sts., Philadelphia, Pa.
Belmont Smelting & Refining Wks., Inc., 348 Belmont Ave., Brooklyn, N. Y.
Bender Warrick Corp., 131 Pierce, Birmingham, Mich.
Bendix Products Corp., 401 Bendix Dr., South Bend, Ind.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Bennett Corp., W. M., 1109 Harney St., Omaha, Nebr.
Benson Co., Inc., Alex R., 1040 Bay Rd., So., Hudson, N. Y.
Berger Mfg. Co., Div. of Republic Steel Corp., 1038 Belden Ave., Canton, O.
Berns Specialty Co., 1015 W. Lake St., Chicago, Ill.
Bernz Co., Inc., Otto, 280 Lyell Ave., Rochester, N. Y.
Berry, Jr., & Co., Inc., F. E., Suite 846 Little Bldg., Boston, Mass.
Bertsch & Co., Inc., Church St., Cambridge City, Ind.
Best Register Co, 2005 W. Oklahoma Ave., Milwaukee, Wis.
Bethlehem Steel Co., Bethlehem, Pa.
Betz Unit Air Cooler Co., 6 W. 9th St., Kansas City, Mo.
Bigelow Co., 92 River St., New Haven, Conn.
Biggs Boiler Wks. Co., Bank St. and B. & O. R. R., Akron, O.
Bignall & Keeler Machine Wks., Edwardsville, Ill.
Billings & Spencer Co., 1 Laurel St., Hartford. Conn.
●Binks Mfg. Co., 3114-40 Carroll Ave., Chicago, Ill.
Bird-Archer Co., 90 West St., New York, N. Y.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., Cleveland, O.
Black & Decker Mfg. Co., Pennsylvania Ave., Towson, Md.
Blackhawk Mfg. Co., Broadway & The River, Milwaukee, Wis.
●Blackmer Pump Co. 1809 Century Ave., S. W., Grand Rapids, Mich.
Blair Products Co., 370 8th Ave., New York, N. Y.
Blaisdell Compressor Co., 227 Fulton St., New York, N. Y.
Blaw-Knox Co., Blawnox, Pa.
Blood Brothers, Allegan, Mich.
Blower Application Co., 918 N. Fourth St., Milwaukee, Wis.
Blue Seal Chemical Co., 177 Westfield Ave., W., Roselle Park. N. J.
Bluffton Mfg. Co., 433 W. Main Cross St., Findlay, O.
Bodine Electric Co., 2254 W. Ohio St., Chicago, Ill.
Boiler Room Equipment, Inc., 45 W. 45th St., New York, N. Y.
●Bonney Forge & Tool Wks., Tilghman St. & Meadow St., Allentown, Pa.
Bordo Co., Inc., L. J., 115 New St., Glenside, Pa.
Bossert Corp., Inc., Lennox & Oswego Sts., Utica, N. Y.
Boston Auto Gage Co., 70 West St., Pittfield, Mass.
Boston Gear Works, Inc., North Quincy, Mass.
Boston Woven Hose & Rubber Co., Broadway, Cambridge, Mass.
Bostwick-Goodell Co., Norwalk, O.
Bowser & Co., Inc., S. F., 1302 E. Creighton Ave., Fort Wayne. Ind.
Boylston Steam Specialty Co., 116-122 W. Illinois St., Chicago, Ill.
Bremil Mfg. Co., Box 1030, Erie, Pa.
Bridgeport Brass Co., E. Main St., Bridgeport, Conn.
Bridgeport Thermostat Co., Connecticut Ave., Bridgeport, Conn.
●Bristol Co., Platts Bridge, Waterbury, Conn.
Bros Boiler & Mfg. Co., Wm., Nicollet Island, Minneapolis, Minn.
Brown, Wm. P., 31 Sanford St., Springfield, Mass.
Brown-Brockmeyer Co., Inc., 1098 Smithville Rd., Dayton, O.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., 4534 Wayne Ave., Philadelphia, Pa.
Brownell Co., 300 N. Findlay St., Dayton, O.
Browning Mfg. Co., Inc., Ohio Valley Pulley Works, Div., Maysville, Ky.
Brunner Mfg. Co., 1821 E. Broad St., Utica, N. Y.
Bryan Steam Corp., P. O. Box 337, Peru, Ind.
Bryant Heater Co., 17825 St. Clair Ave., Cleveland, O.
Bubar, Hudson H., 15 Park Row, New York, N. Y.
Buda Co., Harvey, Ill.
●Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buffalo Meter Co., 2917 Main St., Buffalo, N. Y.
●Buffalo Pumps, Inc., 171 Mortimer St., Buffalo, N. Y.
Buffalo Tank Co., Arlington, Staten Island, N. Y.
Builders Iron Foundry, 9 Codding St., Providence, R. I.
Bullard Co., Brewster St. & Canfield Ave., Bridgeport, Conn.
Bundy Steam Trap Co., Nashua, N. H.
Burdett Mfg. Co., 15 N. Sheldon St., Chicago, Ill.
Burgess Battery Co., 111 W. Monroe St., Chicago, Ill.
Burhorn Co., Edwin, 1 Newark St., Hoboken, N. J.
Burke Electric Co., 1201 W. 12th St., Erie, Pa.
Burke Stoker & Mfg. Co., 921 W. 19th St., Chicago, Ill.
Burling Instrument Co., 241 Springfield Ave., Newark, N. J.
●Burnham Boiler Corp., Main St., Irvington, N. Y.
Burnham Stoker Co., 505 Columbia St., Vancouver, Wash.
Burnley Battery & Mfg. Co., Clay St., North East, Pa.
Burrows Mfg. Co., F. A., 1638 E. Market St., York, Pa.
Burrowes Corp., 70 Free St., Portland, Me.
Burt Air Filter Corp., Grand Central Terminal, New York. N. Y.
Burt Mfg. Co., 44 E. South St., Akron, O.
Bury Compressor Co., 18th & Cascade Sts., Erie, Pa.
●Bush Mfg. Co., 100 Wellington St., Hartford, Conn.
Butler Mfg. Co., 13th & Eastern Ave., Kansas City, Mo.
Butterworth, B. T., Jr., New Canaan, Conn.
Byers Co., A. M., Clark Bldg., Pittsburgh, Pa.

C

Cabot, Inc., Samuel, 141 Milk St., Boston, Mass.
Calbar Paint & Varnish Co., 2612-26 N. Martha St., Philadelphia, Pa.
Caldwell, Farley M., 521 W. Berry St., Fort Wayne, Ind.
Caldwell Co., W. E., 2120 Brook St., Louisville, Ky.
Callite Products Co., 540 39th St., Union City, N. J.
Caloroil Burner Corp., 1477 Park St., Hartford, Conn.
Campbell Heating Co., E. K., 2445 Charlotte St., Kansas City, Mo.
Campbell Heating Co., 31st & Dean, Des Moines, Ia.
Canton Stoker Corp., 407 Andrews Place, S. W., Canton, O.
Capitol Brass Division, Bohn Aluminum & Brass Corp., 2306 Franklin St., Detroit, Mich.
Carbide & Carbon Chemicals Corp., 30 E. 42nd St., New York, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Worthington Ave., Harrison, N. J.
Carbo-Oxygen Co., Benedum-Trees Bldg., Pittsburgh, Pa.
●Carey Co., Philip, Wayne Ave., Lockland, Cincinnati, O.
Carling Turbine Blower Co., 104 Harding St., Worcester, Mass.
Carnegie Illinois Steel Corp., Carnegie Bldg., Pittsburgh, Pa.
Carnes, Inc., John R., Greenlawn Ave. & Erie R.R., Lima, O.
Carpenter & Paterson, Inc., 1190 Bennington St., East Boston, Mass.
Carpenter Steel Co., Reading, Pa.
Carraway-Byrd Engineering Co., 613 N. Pearl St., Dallas, Tex.
Carrick Engineering Co., E. 8th St., Michigan City, Ind.
Carrier Corp., Syracuse, N. Y.

● Advertisement in this issue. **See Index to Advertisers, page 282.**

Carty & Moore Engineering Co., 511 W. Larned St., Detroit, Mich.
Case & Son Mfg. Co., W. A., 33 Main St., Buffalo, N. Y.
Cash Co., A. W., P. O. Box 135, Decatur, Ill.
Cashin Co., W. D., 69 A St., Boston, Mass.
Caterpillar Tractor Co., Peoria, Ill.
●Celotex Co., 919 N. Michigan Ave., Chicago, Ill.
Central Brass Mfg. Co., 2950 E. 55th St., Cleveland, O.
Central Forging Co., Catawissa, Pa.
Central Foundry Co., 386 Fourth Ave., New York, N. Y.
Central Radiator Co., 420 Lexington Ave., New York, N. Y.
Central Station Steam Co., 2910 E. Woodbridge St., Detroit, Mich.
Central Tube Co., First National Bank Bldg., Pittsburgh, Pa.
Central Valve Mfg. Co., 255 E. 95th St., Chicago, Ill.
Centrifix Corp., 3029 Prospect Ave., Cleveland, O.
●Century Electric Co., 1806 Pine St., St. Louis, Mo.
Century Engineering Corp., 213-217 4th Ave., S. E., Cedar Rapids, Ia.
Certain-teed Products Corp., 100 E. 42nd St., New York, N. Y.
Certified Flexible Couplings, Inc., 122 E. 42nd St., New York, N. Y.
Chace Valve Co., W. M., 1606 Beard Ave., Detroit, Mich.
Chain Belt Co., 1644 W. Bruce, Milwaukee, Wis.
Chalmers Oil Burner Co., 1234 Central Ave., Minneapolis, Minn.
Chamberlin Metal Weather Strip Co., 1254 La Brosse St., Detroit, Mich.
Champion Blower & Forge Co., Harrisburg Ave. & Charlotte St., Lancaster, Pa.
Champion Machine & Forging Co., 3678 E. 78th St., Cleveland, O.
Chaplin-Fulton Mfg. Co., 28-40 Penn Ave., Pittsburgh, Pa.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Chase Brass & Copper Co., 236 Grand St., Waterbury, Conn.
Chelsea Metal Stamping Co., 95 8th Ave., New York, N. Y.
Cheney Co., Architects' Bldg., Philadelphia, Pa.
Chicago Belting Co., 113-125 N. Green St., Chicago, Ill.
Chicago Bridge & Iron Wks., 2124 Old Colony Bldg., Chicago, Ill.
Chicago Die Casting Mfg. Co., 2512 W. Monroe St., Chicago, Ill.
Chicago Expansion Bolt Co., 126 S. Clinton St., Chicago, Ill.
●Chicago Metal Hose Corp., Maywood, Ill.
Chicago Metal Mfg. Co., 3724 S. Rockwell St., Chicago, Ill.
Chicago Nipple Mfg. Co., 1966 Southport Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Chicago Pump Co., 2336 Wolfram St., Chicago, Ill.
Chicago Specialty Mfg. Co., 332 N. Western Ave., Chicago, Ill.
Chicago Venetian Blind Co., 3105 W. 27th St., Chicago, Ill.
Chicago-Wilcox Mfg. Co., E. 77th St. & Anthony Ave., Chicago, Ill.
Chisholm Co., Allen E., 2640 E. Burnside St., Portland, Ore.
Cissell Mfg. Co., W. M., 831 S. First St., Louisville, Ky.
Christensen Machine Co., 1975 S. 2nd West St., Salt Lake City, Utah.
Cincinnati Shaper Co., Hopple, Garrard & Elam, Cincinnati, O.
Cincinnati Sheet Metal & Roofing Co., 230 E. Front St., Cincinnati, O.
●Clarage Fan Co., Porter St., Kalamazoo, Mich.
Clark Controller Co., 1146 E. 152 St., Cleveland, O.
Clark Equipment Co., Buchanan, Mich.
Clauss Shear Co., Fremont, O.
Clayton & Lambert Mfg. Co., 11111 French Rd., Detroit, Mich.
Cleaver-Brooks Co., 135 W. Wells St., Milwaukee, Wis.
Cleghorn Co., 86 Broad St., Boston, Mass.
●Clifford Mfg. Co., 564 E. First St., Boston, Mass.
Climax Machinery Co., 121 E. Morris St., Indianapolis, Ind.
Clizbe Bros. Mfg. Co., Plymouth, Ind.
Clow, Jas. B., & Sons, 201 N. Talman Ave., Chicago, Ill.
Cochrane Corp., 3161 N. 17th St., Philadelphia, Pa.
Coe Mfg. Co., Bank St., Painesville, O.
Cohoes Rolling Mill Co., Canvass & Cortland Sts., Cohoes, N. Y.
Cole-Sullivan Engineering Co., 1316 Third St., N., Minneapolis, Minn.
Colebrooks Sons, Inc., W. H., Syracuse, N. Y.
Colonial Stove Co., Specialties Div., E. Somerset, Trenton Ave. and Reading R.R., Philadelphia, Pa.
Columbia Mills, Inc., Saginaw, Mich.
Columbia Radiator Co., 3400 Walnut St., McKeesport, Pa.
Columbian Steel Tank Co., 1509 W. 12th St., Kansas City, Mo.
Columbus Heating & Ventilating Co., 182 N. Yale Ave., Columbus, O.
Columbus Metal Products Co., 767 N. 4th St., Columbus, O.
Columbus Steam Pump Wks. Co., 724 Broderick St., Columbus, O.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., 200 Madison Ave., New York, N. Y.
Commodore Heaters Corp., 11 W. 42nd St., New York, N. Y.
Commonwealth Brass Corp., 5781-5835 Commonwealth Ave., Detroit, Mich.
Commonwealth Mfg. Corp., 4208 Davis Lane, Cincinnati, O.
Conco-Sampsel Stoker Corp., Mendota, Ill.
Conditionaire Unit Co., 2821 Montrose Ave., Chicago, Ill.
Conneaut Packing Co., Conneaut, O.
Connery Construction Co., 2nd & Luzerne Sts., Philadelphia, Pa.
Consolidated Air Conditioning Corp., 114 E. 32nd St., New York, N. Y.
Continental Diamond Fibre Co., Newark, Del.
Continental Electric Co., Inc., 323 Ferry St., Newark, N. J.
Continental Motors Corp., 12802 Jefferson Ave., E., Detroit, Mich.
Continental Rubber Wks., 1905 Liberty Blvd., Erie, Pa.
Continental Steel Corp., 1108 S. Main St., Kokomo, Ind.
Continental Stove Corp., Front & Walnut Sts., Ironton, O.
Cook Electric Co., 2700 Southport Ave., Chicago, Ill.
Cooling Tower Co., Inc., 15 John St., New York, N. Y.
Cooper Co., Clark, 159 Jefferson St., Philadelphia, Pa.
Cooper Sanitary Co., 3336 Chestnut St., Philadelphia, Pa.
Copeland Refrigeration Corp., 1331 Holden Ave., Detroit, Mich.
Copper Boilers, Inc., 304 Hudson St., New York, N. Y.
Coppus Engineering Corp., 374 Park Ave., Worcester, Mass.
●Cork Import Corp., 330 W. 42nd St., New York, N. Y.
Cork Insulation Co., Inc., 155 E. 44th St., New York, N. Y.
Corley Co., 629 Grove St., Jersey City, N. J.
Cornell Iron Wks., Inc., 36th Ave. & 13th St., Long Island City, N. Y.
Cornell Wood Products Co., 230 N. Michigan Ave., Chicago, Ill.
Corning Glass Works, Corning, N. Y.
Corozone Air Conditioning Corp., 1422 Euclid Ave., Cleveland, O.
Crandall Packing Co., Palmyra, N. Y.
●Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Crane Packing Co., 1801 Belle Plaine Ave., Chicago, Ill.
Crawford Co., 3220 W. 31st St., Chicago, Ill.
Crew-Sargent Controls, Inc., 101 Park Ave., New York, N. Y.
Crise Elec. Mfg. Co., 316-20 S. Main St., Mt. Vernon, O.
Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.
Croll & Son, Jesse G., 2326-2606 Germantown Ave., Philadelphia, Pa.
Croll-Reynolds Engineering Co., Inc., 17 John St., New York, N. Y.
Cross Engineering Co., 160-178 Dundaff St., Carbondale, Pa.
Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y.
Cryer Trap & Valve Co., Inc., 366 Madison Ave., New York, N. Y.
Crystal Refrigerator Co., Fremont, Neb.
Cuno Engineering Corp., 80 S. Vine St., Meriden, Conn.
Curtis & Curtis Co., 450 Garden St., Bridgeport, Conn.
●Curtis Refrigerating Machine Co., 1950 Kienlen Ave., St Louis, Mo.
Cutler-Hammer, Inc., N. 12th St. & W. St. Paul Ave., Milwaukee, Wis.

D

Dahlquist Mfg. Co., Inc., 40 W. 3rd St., Boston, Mass.
Dallas Engineering Co., 1115 Hall, Dallas, Tex.
Dampney Co. of America, 1243 River St., Hyde Park, Boston, Mass.
Darcoid Co., Inc., 200 Varick St., New York, N. Y.
Darling Valve & Mfg. Co., 701 Walnut St., Williamsport, Pa
●Dart Mfg. Co., E. M., 134 Thurber Ave., Providence, R. I.
Davenport Mfg., Co., 301 W. College St., Meadville, Pa.
Davidson Co., M. T., 154 Nassau St., New York, N. Y.
Davidson Hy Duty Roof Fan Co., 213 California St., Newton, Mass.
Davies Air Filter Co., 390 Fourth Ave., New York, N. Y.
Davis Engineering Corp., 1064 E. Grand St., Elizabeth, N. J.
Davis Regulator Co., 2546 S. Washtenaw Ave., Chicago, Ill.
Dayton Air Compressor Co., Dayton, O.
Dayton-Dowd Co., 115-17 York St., Quincy, Ill.
Dayton Rogers Mfg. Co., 2830 S. 13th Ave., Minneapolis, Minn.
●Dayton Rubber Mfg. Co., 2345 W. Riverview Ave., Dayton, O.
Dean Bros. Co., 323 W. 10th St., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Debevoise Co., 968 Grand Ave., Brooklyn, N. Y.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., 100-6th Ave., New York, N. Y.
Decatur Pump Co., 2750 Nelson Park Rd., Decatur, Ill.
Defender Automatic Regulator Co., 308 S. 8th St., St. Louis, Mo.
De Laval Steam Turbine Co., 300 Nottingham Way, Trenton, N. J.
De La Vergne Engine Co., Philadelphia, Pa.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., 1420 Wisconsin Blvd., Dayton, O.
●Delco Products Corp., 329 E. First St., Dayton, O.
Delta-Star Electric Co., 2400 Block, W. Fulton St., Chicago, Ill.
Delta Stoker Co., Foot of Commonwealth, North Chicago, Ill.
●Deming Co., 14 Aetna St., Salem, O.
Desolvo Mfg. Co., 33 Terminal Way, Pittsburgh, Pa.
d'Este Co., Julian, 6 Spice St., Charlestown, Mass.
●Detroit Air Meter Co., Box 1473, Detroit, Mich.
Detroit Brass & Malleable Works, 100 S. Campbell, Detroit, Mich.
Detroit Graphite Co., 550 12th St., Detroit, Mich.
●Detroit Lubricator Co., 5900 Trumbull Ave., Detroit, Mich.
Detroit Seamless Steel Tubes Co., c/o Grand River Station, Detroit, Mich.
●Detroit Stoker Co., Sales and Engineering Offices, General Motors Bldg., Detroit, Mich.; Works at Monroe, Mich.

● Advertisement in this issue. See Index to Advertisers, page 282.

●Detroit Stoker Co. of Canada, Ltd., Canada Bldg., Windsor, Ont.; **Works at London, Ont.**
De Vilbiss Co., 300 Phillips St., Toledo, O.
Devine Mfg. Co., Inc., J. P., 909 Shawnee Ave., Mt. Vernon, Ill.
Devlin Mfg. Co., Inc., Thomas, Burlington, N. J.
Diamond Chain & Mfg. Co., 400 Kentucky Ave., Indianapolis, Ind.
Diamond Expansion Bolt Co., 500 North Ave., Garwood, N. J.
Diamond **Mfg. Co., 253 W. Eighth St., Wyoming, Pa.**
Diamond Power Specialty Co., 10340 Oakland, Detroit, Mich.
Dick **Co., Inc., R. & J., 24-48 Sade St., Passaic, N. J.**
Diehl Mfg. Co., Trumbull St., Elizabeth, N. J.
Dillon Steam Boiler Wks., Inc., D. M., Crocker St., Fitchburg, Mass.
Direct Separator Co., Inc., 218 S. Geddes St., Syracuse, N. Y.
Dissolene Corp., Hempstead, N. Y.
Dixie Mfg. Co., Inc., 1310 Russell St., Baltimore, Md.
Dixon Crucible Co., Joseph, Wayne & Monmouth Sts., Jersey City, N. J.
Dockstader, S. E., 305 Munsey Bldg., Washington, D. C.
Dodge Mfg. Co., 500 S. Union St., Mishawaka, Ind.
Dole Valve Co., 1901-33 Carroll Ave., Chicago, Ill.
Domestic Engine & Pump Co., 50 Church St., New York, N. Y.
Douglass Pipe Machine Co., 707 Water St., St. Joseph, Mich.
Downingtown Iron Wks., Wallace Ave., Downingtown, Pa.
Dracco Corp., 4057 E. 116th St., Cleveland, O.
Dravo Corp., Dravo Bldg., Pittsburgh, Pa.
Dreis & Krump Mfg. Co., 7404 Loomis Blvd., Chicago, Ill.
Dresser Mfg. Co., S. R., 490 Fisher Ave., Bradford, Pa.
●Dunham Co., C. A., 450 E. Ohio St., Chicago, Ill.
Dunn Inc., Struthers, 153 N. Juniper St., Philadelphia, Pa.
du Pont de Nemours & Co., E. I., R. & H. Chemicals Dept., Wilmington, Del.
Durabla Mfg. Co., 114 Liberty St., New York, N. Y.
Durakool, Inc., 1010 N. Main St., Elkhart, Ind.
Duraloy Co., S. 26th St., Pittsburgh, Pa.
Duriron Co., Inc., 450 N. Findlay St., Dayton, O.
Duro Co., 537 Monument Ave., Dayton, O.
Dustlix Systems, Inc., 715 N. Van Buren St., Milwaukee, Wis.

E

Eagle-Picher Lead Co., Temple Bar Bldg., Cincinnati, O.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Eastman Kodak Co., Kodak Park, Rochester, N. Y.
Eclipse Aviation Corp., 545 N. Arlington Ave., East Orange, N. J.
Eclipse Fuel Engineering Co., 707 S. Main St., Rockford, Ill.
Econocol Stoker Div. of Cotta Transmission Corp., 2340 11th St., Rockford, Ill.
Economy Electric Mfg. Co., 4634 W. 21st Pl., Chicago, Ill.
Economy Equipment Co., 223 N. Wolcott Ave., Chicago, Ill.
Economy Pumps, Inc., 2522 W. Congress St., Chicago, Ill.
Eddy Stoker Corp., 4717 W. North Ave., Chicago, Ill.
Eddy Valve Co., Waterford, N. Y.
Edge Moor Iron Wks., 30 Rockefeller Plaza, New York, N. Y.
Edison, Inc., Thomas A., Edison Electrical Controls Div., Lakeside Ave., West Orange, N. J.
Edward Valve & Mfg. Co., 1200 W. 145th St., East Chicago, Ind.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Eisler Engineering Corp., 760 S. 13th St., Newark, N. J.
Electric Air Heater Co., Division of American Foundry Equipment Co., 555 Byrkit St., Mishawaka, Ind.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., Caledonia & Gillette Sts., La Crosse, Wis.
Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, O.
Electro Hot Heater Co., 4302 S. Tacoma Way, Tacoma, Wash.
Electric Machinery Mfg. Co., 1331 Tyler St., N. E., Minneapolis, Minn.
Electric Valve Mfg. Co., Inc., 68 Murray St., New York, N. Y.
Electrimatic Corp., 2100 Indiana Ave., Chicago, Ill.
Electroaire Corp., 1455-57 W. Congress St., Chicago, Ill.
Electrol, Inc., 934 Main Ave., Clifton, N. J.
Electrovent Fan & Mfg. Co., 812 W. Lake St., Chicago, Ill.
Elgin Softener Corp, Elgin, Ill.
Elgo Shutter & Mfg. Co., 634 W. Warren Ave., Detroit, Mich.
Elliott Co., Jeannette, Pa.
Ellis Drier Co., 2444 N. Crawford Ave., Chicago, Ill.
Ellison Draft Gage Co., 214 W. Kinzie St., Chicago, Ill.
Elsey Metal Specialties Co., 1535 Spruce St., Detroit, Mich.
Emerson Electric Mfg. Co., 1847 Washington Ave., St. Louis, Mo.
Endura Mfg. Corp., 45 N. 4th St., Quakertown, Pa.
Engelhard, Inc., Charles, 90 Chestnut St., Newark, N. J.
Engineer Co., 17 Battery Pl., New York, N. Y.
Enterprise Oil Burner Co., 2949 18th St., San Francisco, Cal.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Erie City Iron Wks., 1500 East Ave., Erie, Pa.
Erie Tool Wks., 11th & French Sts., Erie, Pa.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Everlasting Valve Co., 49 Fisk St., Jersey City, N. J.
Evry-Use Products, Inc., 260 Canal St., New York, N. Y.
Excelsior Leather Washer Co., 700 Chestnut St., Rockford, Ill.
Excelsior Steel Furnace Co., 118 So. Clinton St., Chicago, Ill.
Excelsior Tool & Machine Co., 31st & Ridge Ave., East St. Louis, Ill.
Excelso Products Corp., 65 Clyde Ave., Buffalo, N. Y.

F

Fabling Co., W. D., 722 N. Broadway, Los Angeles, Cal.
Fafnir Bearing Co., 37 Booth St., New Britain, Conn.
●**Fairbanks Co., 396 Lafayette St., New York, N. Y.**
Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill.
Fairmont Aluminum Co., Fairmont, W. Va.
Falstrom Co., Main Ave. & D. L. & W. R.R., Passaic, N. J.
Farley Sleeve & Hanger Co., 3748 E. 71st St., Cleveland, O.
Farquhar Co., Ltd., A. B., Duke St., York, Pa.
Farrar & Trefts, 9 Grimes St., Buffalo, N. Y.
●Fedders Mfg. Co., Inc., 57 Tonawanda St., Buffalo, N. Y.
Fee and Stemwedel, Inc., 4949 N. Pulaski Rd., Chicago, Ill.
Felt Products Mfg. Co., 1514 Carroll Ave., Chicago, Ill.
Felters Co., Inc, 210 South St., Boston, Mass.
Ferguson & Lange Foundry Co., 1039 Willow St., Chicago,Ill.
Ferro-Nil Corp., 373 Fourth Ave., New York, N. Y.
Field Mfg. Co., 2328 Nelson St., Chicago, Ill.
Filtrine Mfg. Co., Inc., 53 Lexington Ave., Brooklyn, N. Y.
Firemood Machine Wks., Converse, Ind.
Firestone Tire & Rubber Co., S. Main St., Akron, O.
Fir-Tex Insulating Board Co., St. Helens, Ore.
Fisher Governor Co., 102-17 S. First St., Marshalltown, Ia.
Fitzgibbons Boiler Co., Inc., 101 Park Ave., New York, N. Y.
Flagg & Co., Inc., Stanley G., 1421 Chestnut St., Philadelphia, Pa.
Flemm Lead Co., Inc., Bradley Ave. & School St., Long Island City, N. Y.
Flexitallic Gasket Co., 8th & Bailey Sts., Camden, N. J.
Flexo Supply Co., Inc., 4221 Olive St., St. Louis, Mo.
Floersheim & Co., B., Farmers Bank Bldg., Pittsburgh, Pa.
Fluor Corp., 909 E. 59th St., Los Angeles, Cal.
Flynn & Emrich Co., 301 N. Holliday St., Baltimore, Md.
Follansbee Bros. Co., 3rd & Liberty Aves., Pittsburgh, Pa.
Forest City Foundries Co., 2500 W. 27th St., Cleveland, O.
Forslund Pump & Machinery Co., 1717-19 Main St., Kansas City, Mo.
Foster Engineering Co., 109 Monroe St., Newark, N. J.
Foster Pump Wks., Inc., 46 Washington St., Brooklyn, N. Y.
Foster Wheeler Corp., 165 Broadway, New York, N. Y.
Fowler & Wolfe Radiator Co., Oak & Carson Sts., Norristown, Pa.
Foxboro Co., 106 Neponset Ave., Foxboro, Mass.
France Packing Co., 6512 Tacony St., Tacony, Philadelphia, Pa
Frank Engineering Co., 11 Park Place, New York, N. Y.
Frederick Iron and Steel Co., E. 7th St., Frederick, Md.
Fresh-'nd-Aire Co., 430 W. Erie St., Chicago, Ill.
Fulflo Specialties Co., Blanchester, O.
Fretz-Moon Tube Co., Inc., Butler, Pa.
●Frick Co., Waynesboro, Pa.
Friez & Sons, Inc., Julien P., 4 N. Central Ave., Baltimore, Md.
Frost Mfg. Co., S. Henderson St., Galesburg, Ill.
Fuel Savers, Inc., 15th & Herr Sts., Harrisburg, Pa.
Fuller Co., 124 Bridge St., Catasauqua, Pa.
●Fulton Sylphon Co., Knoxville, Tenn.

G

Garden City Fan Co., 332 S. Michigan Ave., Chicago, Ill.
Gardiner Metal Co., 2514 W. 48th Pl., Chicago, Ill.
Gardner, Bernard, 632 W. 130th St., New York, N. Y.
Gardner-Denver Co., Quincy, Ill.
Garlock Packing Co. 50 Main St., Palmyra, N. Y.
Gasweld & Airway, Inc., 625 W. Jackson Blvd., Chicago, Ill.
Gates Rubber Co., 999 S. Broadway, Denver, Col.
Gatke Corp., 228 N. La Salle St., Chicago, Ill.
G. D. S. Machinery & Supply Co., Inc., 101 Walker St., New York, N. Y.
Gehl Bros. Mfg. Co., West Bend, Wis.
General Air Conditioning Corp., 4411 Appleton St., Cincinnati, O.
General Blower Co., Inc., 2402 Market St., Philadelphia, Pa.
General Bronze Corp., Hancock & Boulevard, Long Island City, N. Y.
General Ceramics Co., 71 W. 35th St., New York, N. Y.
●General Controls Co., 1370 Harrison St., San Francisco, Cal. and 1505 Broadway, Cleveland, O.
●General Electric Co., 1 River Rd., Schenectady, N. Y.
General Equipment Co., 315 S. Wichita, Wichita, Kan.
General Fittings Co., 123 Georgia Ave., Providence, R. I.
General Gas Light Co., 212 N. Park, Kalamazoo, Mich.
General Insulating & Mfg. Co., 125 Fairview Ave., Alexandria, Ind.
General Insulating Products Co., 8821 15th Ave., Brooklyn, N. Y.
General Plate Co., 34 Forrest St., Attleboro, Mass.
General Refrigeration Corp., Shirland Ave., Beloit, Wis.
Gerstein & Cooper Co., 1 W. Third St., South Boston, Mass.
Geuder, Paeschke & Frey Co., W. St. Paul Ave. & N. 15th St., Milwaukee, Wis.
Giant Grip Mfg. Co., 30 Osceola St., Oshkosh, Wis.
Giant Mfg. Co., South Ave., Council Bluffs, Ia.
Gilbert & Barker Mfg. Co., Cold Spring Ave., Springfield, Mass.
Gillian Mfg. Co., 650 E. Troy Ave., Ferndale, Mich.
Gilmer Company, L. H., Keystone & Cottman Sts., Tacony, Philadelphia, Pa.
Gleason-Avery, Inc., 27 Clark St., Auburn, N. Y.
Globe Machine & Stamping Co., 1220 W. 76th St., Cleveland, O.

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Globe Steel Tubes Co., 3839 W. Burnham St., Milwaukee, Wis.
Globe Ventilator Co., 205 River St., Troy, N. Y.
Glore Sales Corp., Evins F., 1949 Grand Central Terminal Bldg., New York, N. Y.
G. M. Mfg. Co., P. O. Box 151, Madison Square Sta., New York, N. Y.
●G & O Mfg. Co., 138 Winchester Ave., New Haven, Conn.
Goethel Co., Alfred C., 2337 N. 31st St., Milwaukee, Wis.
Goethel Sheet Metal Wks., Alfred, 1910 N. Killian Pl., Milwaukee, Wis.
Goetze Gasket & Packing Co., Inc., 60 Allen Ave., New Brunswick, N. J.
Golden-Anderson Valve Specialty Co., Fulton Bldg., Pittsburgh, Pa.
Goodell-Pratt Co., 57 Wells St., Greenfield, Mass.
Goodrich Co., B. F., 548 S. Main St., Akron, O.
Goodyear Tire & Rubber Co., E. Market St., Akron, O.
Gorton Heating Corp., Cranford, N. J.
Goulds Pumps, Inc., Fall St., Seneca Falls, N. Y.
Grabler Mfg. Co., 6565 Broadway, Cleveland, O.
Graham Mfg. Co., Inc., 220 Delaware Ave., Buffalo, N. Y.
Grand Rapids Blow Pipe & Dust Arrester Co., 525-28 Monroe Ave., Grand Rapids, Mich.
Granite City Steel Co., 20th & Madison Ave., Granite City, Ill.
Graton & Knight Mfg. Co., 356 Franklin St., Worcester, Mass.
Graver Tank & Mfg. Co., Inc., 4809 Todd Ave., East Chicago, Ind.
Greene, Tweed & Co., 109 Duane St., New York, N. Y.
Greenfield Tap & Die Corp., Sanderson St., Greenfield, Mass.
●Grinnell Co., Inc., 260 W. Exchange, Providence, R. I.
Griscom-Russell Co., 285 Madison Ave., New York, N. Y.
Guardian Utilities Co., 1023 E. 46th St., Chicago, Ill.
Guild & Garrison, Inc., 463 Kent Ave., Brooklyn, N. Y.
Gulf States Steel Co., Brown-Marx Bldg., Birmingham, Ala.
Guth Co., Edwin F., 2615 Washington Blvd., St. Louis, Mo.

H

Haering Co., Inc., D. W., 3408 W. Monroe St., Chicago, Ill.
Hagan Corp, 502 Bowman Bldg., Pittsburgh, Pa.
Haines & Co., William S., 12th & Buttonwood Sts., Philadelphia, Pa.
Hamburg Boiler Wks., Inc., Grand St., Hamburg, Pa.
Hamilton Rubber Mfg. Co., Mead St., Trenton, N. J.
Hammett Mfg. Co, 1907 Holmes St., Kansas City, Mo.
Hammond Brass Wks., Summer Blvd., Hammond, Mich.
Hampden Cornice Wks., Inc., 300 Birnie Ave., Springfield, Mass.
Handy & Harman, 82 Fulton St., New York, N. Y.
Hardinge Oil Burner Co., 1770 Berteau St., Chicago, Ill.
Hardy Mfg. Co., Inc., 100 Davis Ave., Dayton, O.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.
Harrington & King Perforating Co., 5655 Fillmore St., Chicago, Ill.
Harris & Co., Arthur, 210 N. Aberdeen St., Chicago, Ill.
Harris Calorific Co., 5501 Cass Ave., N. W., Cleveland, O.
Harrisburg Foundry & Machine Co., Inc., 7th & Curtin St., Harrisburg, Pa.
Harrisburg Steel Corp., 10th & Herr Sts., Harrisburg, Pa.
Hart & Cooley Mfg. Co., 61 W. Kinzie St., Chicago, Ill.
Hart & Crouse Co., Inc., 301 Turner St., Utica, N. Y.
●Hart Mfg. Co., Hamilton St., Hartford, Conn.
Hartmann Co., Chas., 985 Dean St., Brooklyn, N. Y.
Hartzell Propeller Fan Co., P. O. Box 909, Roosevelt Ave., Piqua, O.
Hasco Valve & Machine Co., 1819 W. St. Paul Ave., Milwaukee, Wis.
Hatch, George E., 10 E. 40th St., New York, N. Y.
Hays Corp., E. 8th St., Michigan City, Ind.
Hays Mfg. Co., 801 W. 12th St., Erie, Pa.
H-B Instrument Co., 2518 N. Broad St., Philadelphia, Pa.
Healy Ruff Co., 765 Hampden Ave., St. Paul, Minn.
Heartley Machine & Tool Co., 900-8 Summit Ave., Toledo, O.
Heating Assurance, Inc., 124 E. Augusta St., Spokane, Wash.
Heat Transfer Co., Huntington, Ind.
Hegeler Zinc Co., P. O. Box 599, Danville, Ill.
Heil Co., 3000 Montana St., Milwaukee, Wis.
Hendley & Whittemore, 6 Blackhawk Blvd., Beloit, Wis.
Hendrick Mfg. Co., 37 Dundaff St., Carbondale, Pa.
●Henry Furnace & Foundry Co., 3480 E. 49th St., Cleveland, O.
●Henry Valve Co., 1019 N. Spaulding Ave., Chicago, Ill.
Herbert Boiler Co., Root & La Salle Sts., Chicago, Ill.
Her-Born Engineering & Mfg. Co., 212 Columbus Ave., Sandusky, O.
Hercules Chemical Co., Inc., 332 Canal St., New York, N. Y.
Hercules Float Wks., 200 Franklin St., Springfield, Mass.
Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.
Hexcel Radiator Co., 2500 Flett Ave., Racine, Wis.
Higgin Products, Inc., Newport, Ky.
Hill Diesel Engine Co., Lansing, Mich.
●Hill, E. Vernon, 179 W. Washington St., Chicago, Ill.
Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn, N. Y.
Hinde & Dauch Paper Co., Sandusky, O.
Hirschman Co., W. F., 220 Delaware Ave., Buffalo, N. Y.
Hobart Bros., Hobart Sq., Troy, O.
Hodge Boiler Wks., Summer St., East Boston, Mass.
Hodgman Mfg. Co., 135 Washington St., Taunton, Mass.
Hoffman Combustion Engineering Co., 410 Ford Bldg., Detroit, Mich.
●Hoffman Specialty Co., Inc., Waterbury Natl. Bank Bldg., Waterbury, Conn.
Holcomb & Hoke Mfg. Co., 1545 Van Buren, Indianapolis, Ind
Hollands Mfg. Co., Erie, Pa.
Hollup Corp., 3357 W. 47th Pl., Chicago, Ill.
●Holtzer-Cabot Electric Co., 125 Amory St., Boston, Mass.
Homestead Valve Mfg. Co., P. O. Box H, Coraopolis, Pa.
Hoosick Engineering Co., Inc., Branch No. 1, 23 Elm St., Hoosick Falls, N. Y.
Hoppes Mfg. Co., 850 N. Belmont Ave., Springfield, O.
Horton Mfg. Co., 3016 University Ave., S. E., Minneapolis, Minn.
Hotstream Heater Co., 8007 Grand Ave., Cleveland, O.
Hough Co., Janesville, Wis.
Houghton & Co., E. F., 240 W. Somerset St., Philadelphia, Pa.
Hound Packing Co., 4757 E. Ravenswood Ave., Chicago, Ill.
Howard Iron Wks. & Alberger Heater Co., 287 Chicago St., Buffalo, N. Y.
Howe Ice Machine Co., 2825 Montrose Ave., Chicago, Ill.
Howell Electric Motors Co., Howell, Mich.
Howell Mfg. Co., 1625 Cleveland, Kansas City, Mo.
Hugo Mfg. Co., 49th Ave., W., & Superior St., West Duluth, Minn.
Hull Mfg. Co., Pennsylvania & Prospect Ave., Hagerstown, Md.
Humidi-Cooler Corp., New Haven, Conn.
●Hussey & Co., C. G., 2850 Second Ave., Pittsburgh, Pa.
Huyette Co., Inc., Paul B., 401 N. Broad St, Philadelphia, Pa.
Hyatt Roller Bearing Co., Harrison, N. J.
Hynes Electric Heating Co., 240 Cherry St., Philadelphia, Pa

I

Ideal Commutator Dresser Co., 1096 Park Ave., Sycamore, Ill.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, O.
Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.
●Illinois Engineering Co., 2035 S. Racine Ave., Chicago, Ill.
Illinois Iron & Bolt Co., 918 S. Michigan Ave., Chicago, Ill.
Illinois Malleable Iron Co., 1801 Diversey Ave., Chicago, Ill.
●Illinois Testing Laboratories, 420 N. LaSalle St., Chicago, Ill.
Illinois Zinc Co., 332 S. Michigan Ave., Chicago, Ill.
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill
Imperial Electric Co., 64 Ira Ave., Akron, O.
●Independent Air Filter Co., 228 N. La Salle St., Chicago, Ill.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
●Independent Register Co., 3747 E. 93rd St., Cleveland, O.
Indian Refining Co., 5 E. Market, Indianapolis, Ind.
Indian Trailer Corp., Koolroom Div., 2338 Indiana Ave., Chicago, Ill.
Industrial Apparatus Co., 720 N. Wabash Ave., Chicago, Ill
●Ingersoll-Rand, 11 Broadway, New York, N. Y.
Ingersoll Steel & Disc Co., 310 S. Michigan Ave., Chicago, Ill
Inland Mfg. Co., 1120 N. Cicero Ave., Chicago, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Insto-Gas Corp., 1900 E. Jefferson, Detroit, Mich.
Insulite Co., 1100 Builders Exchange Bldg., Minneapolis, Minn
Inter-Coastal Paint Corp., 15th St. and Southern R. R., East St. Louis, Ill.
International Boiler Works Co., East Stroudsburg, Pa.
International Draft Control Co., 6611 Euclid Ave., Cleveland, O.
International Engineering, Inc., 1145 Bolander Ave., Dayton, O.
International Engineering Wks., Inc., Box 71, Framingham, Mass.
International Heater Co., 101 Park Ave., Utica, N. Y.
International Moistening Co., 36 Exchange Pl., Providence, R. I.
International Nickel Co., 67 Wall St., New York, N. Y.
International Nutyp Tool Corp., 68 W. First St., Oswego, N. Y.
International Vermiculite Co., 11th & Stanford Ave., Springfield, Ill.
Iona Ventilator Co., Inc., 2821-29 W. Dauphin St., Philadelphia, Pa.
Iron Fireman Mfg. Co., 3170 W. 106th St., Cleveland, O.

J

Jackson Co., Byron, 2150 E. Slauson Ave., Los Angeles, Cal.
Jackson & Church Co., 321 N. Hamilton Ave., Saginaw, Mich.
Jacobs Co., B. & J., 1729 John St., Cincinnati, O.
Jamar Co., Walker, 367 S. First Ave. E., Duluth, Minn.
Janette Mfg. Co., 556 W. Monroe St., Chicago, Ill.
Jarecki Mfg. Co., 1345 W. 12th St., Erie, Pa.
Jefferson Electric Co., 25th & Madison St., Bellwood, Ill.
Jefferson Union Co., Lexington, Mass.
Jeffrey Mfg. Co., 956 N. Fourth St., Columbus, O.
Jenkins Bros., 80 White St., New York, N. Y.
Jenkins Mfg. Co., 2 W. 45th St., New York, N. Y.
Jennison Co., 17 Putnam St., Fitchburg, Mass.
Johns-Manville, 22 E. 40th St., New York, N. Y.
Johnson Bronze Co., S. Mill St., New Castle, Pa.
Johnson Co., S. T., 940 Arlington St., Oakland, Cal.; 401 N. Broad St., Philadelphia, Pa.
Johnson Corp., 830 Wood St., Three Rivers, Mich.
●Johnson Fan & Blower Corp., 1320 W. Lake St., Chicago, Ill.
Johnson Mfg. Co., 10th & Sycamore, Waterloo, Ia.
●Johnson Service Co., 507 E. Michigan St., Milwaukee, Wis.

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Johnson Tool Co., 65-67 Massasoit Ave., East Providence, R. I.
Johnston & Jennings Co., 877 Addison Rd., Cleveland, O.
Johnston Bros., Inc., Ferrysburg, Mich.
Johnston Co., William W., 115 Bayard St., Dayton, O.
Joliet Heating Corp., 2101 Herkimer St., Joliet, Ill.
Jones Foundry Machine Co., W. A., 4401 W. Roosevelt Rd., Chicago, Ill.
Jones & Laughlin Steel Corp., Third & Ross St., Pittsburgh, Pa.
Jordan & Co., Paul R., 631 S. Delaware St., Indianapolis, Ind.
Justus Steam Trap Co., Napanoch, N. Y.

K

Kainer & Co., 761 W. Lexington, Chicago, Ill.
Kaiser Co., H. S., 3336 Franklin Blvd., Chicago, Ill.
Kane Mfg. Corp., Kane, Pa.
Kauffman Air Conditioning Corp., 4485 Olive St., St. Louis, Mo.
Kaye & MacDonald, Inc., 92 Franklin Ave., West Orange, N. J.
Keasbey & Mattison Co., Butler Ave., Ambler, Pa.
Keasbey Co., Robert A., 139-149 W. 19th St., New York, N. Y.
Keckley Co., O. C., 565 W. Washington Blvd., Chicago, Ill.
Keeler Co., E., 238 West St., Williamsport, Pa.
Keeney Mfg. Co., Main St., Newington, Conn.
Kellogg Co., M. W., The, 225 Broadway, New York, N. Y.
Kellogg Compressor & Mfg. Co., 97 Humboldt St., Rochester, N. Y.
Kelly-Koet, Covington, Ky.
●Kelvin-White Co., 90 State St., Boston, Mass.
●Kelvinator Div., Nash-Kelvinator Corp., 14250 Plymouth Rd., Detroit, Mich.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kernchen Co., 103 E. Wacker Drive, Chicago, Ill.
Kerotest Mfg. Co., 2525 Liberty Ave., Pittsburgh, Pa.
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
●Kewanee Boiler Corp., Kewanee, Ill.
Key Co., 2700 McCasland, East St. Louis, Ill.
Kidder Mfg. Co., Inc., J. F., 426 Colchester Ave., Burlington, Vt.
Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y.
Kinetic Chemicals, Inc., 10th & Market St., Wilmington, Del.
King-Seeley Corp., 302 Second St., Ann Arbor, Mich.
King Union Co., Inc., Hillsgrove, R. I.
King Ventilating Co., Box 178, Owatonna, Minn.
Kingsford Foundry & Machine Wks., 264 W. Second St., Oswego, N. Y.
Kinney Mfg. Co., 3529 Washington St., Boston, Mass.
Kirk & Blum Mfg. Co., 2838-52 Spring Grove Ave., Cincinnati, O.
Kisco Co., Inc., 4414-18 W. Papin St., St. Louis, Mo.
Kleenaire Corp., 409 Jefferson St., Stevens Point, Wis.
Kleen-Heet, Inc., 1823 Carroll Ave., Chicago, Ill.
Klingerit, Inc., 16-22 Hudson St., New York, N. Y.
Klipfel Mfg. Co., 2651 W. Harrison St., Chicago, Ill.
Knickerbocker Co., Jackson, Mich.
Knight, Maurice A., Kelly Ave., Akron, O.
Knowles Mushroom Ventilator Co., 41 N. Moore St., New York, N. Y.
Kol-Master Corp., Oregon, Ill.
Kopperman & Sons, Joseph B., 316 New St., Philadelphia, Pa
Korfund Co., 48-15 32nd Pl., Long Island City, N. Y.
●Korput, A. V. D., da Castalaan 2, Baarn, Holland.
Koven & Bro., L. O., 154 Ogden Ave., Jersey City, N. J.
Kraissl Co., Inc., 620 Main St., Hackensack, N. J.
●Kuhns Bros. Co., 1800 McCall St., Dayton, O.

L

La Bour Pump Co., Inc., 1301 Sterling Ave., Elkhart, Ind.
Laclede Steel Co., Arcade Bldg., Rm. 1317, St. Louis, Mo.
Laclede Stoker Co., 4438 Hunt Ave., St. Louis, Mo.
La Crosse Tractor Co., La Crosse, Wis.
Laminated Metals Corp., 775 Eddy St., Providence, R. I.
Lammert & Mann Co., 281 N. Wood St., Chicago, Ill.
Lamneck Products, Inc., 416-36 Dublin Ave., Columbus, O
Lamson & Sessions Co., 1971 W. 85th St., Cleveland, O.
Landis Machine Co., 5th & Church Sts., Waynesboro, Pa.
Larkin Packer Co., 6200 Maple Ave., St. Louis, Mo.
Larkin Refrigerating Corp., 519 Fair St., S. E., Atlanta, Ga.
Lawler Automatic Controls, Inc., 453 N. MacQuesten Pkwy., Mount Vernon, N. Y.
Lawrence Pump & Engine Co., P. O. Box 70, Lawrence, Mass.
Lawson Co., F. H., Evans & Whately Sts., Cincinnati, O.
●Layne & Bowler, Inc., Memphis, Tenn.
Lead Lined Iron Pipe Co., 1 Broadway, Wakefield, Mass.
Leavitt Machine Co., East River St., Orange, Mass.
Lecourtenay Co., 5 Maine St., Newark, N. J.
Lee Heating Systems, 810 Union National Bank Bldg., Youngstown, O.
Lee & Son Co., Thomas, 128-132 W. Second St., Cincinnati, O.
Leeds & Northrup Co., 4952 Stenton Ave., Philadelphia, Pa.
Leffel & Co., James, 426 East St., Springfield, O.
Lehigh Fan & Blower Co., Front & Linden Sts., Allentown, Pa.
Leiman Bros., Inc., 146-181 Christie St., Newark, N. J.
Leland Electric Co., 1501 Webster St., Dayton, O.
Lennox Furnace Co., Marshalltown, Ia., and Syracuse, N. Y.
Leonard Valve Co., 1360 Elmwood Ave., Providence, R. I.
Leslie Co., Valley Brook & Grant Aves., Lyndhurst, N. J.
Lewis & Co., Inc., Chas. S., 2207 Pine St., St. Louis, Mo.
Lewis & Co., Joseph E., 1218 Warner St., Baltimore, Md.
Lilie-Hoffman Cooling Towers, Inc., 4239 Duncan Ave., St. Louis, Mo.
Limbert & Co., Geo. B., 570 Fulton St., Chicago, Ill.
Lincoln Electric Co., 12818 Coit Rd., Cleveland, O.
●Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill.
Liquid Carbonic Corp., 3100 S. Kedzie Ave., Chicago, Ill.
Liquidometer Corp., 36-16 Skillman Ave., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, 23-01 Borden Ave., Long Island City, N. Y.
Little Mfg. Co., M. S., 151 New Park Ave., Hartford, Conn.
Littleford Bros., 421 E. Pearl St., Cincinnati, O.
Locke Regulator Co., 76 North St., Salem, Mass.
Lockport Fittings Co., Inc., Lockport, N. Y.
Logan Engineering Co., 4541 Ravenswood Ave., Chicago, Ill.
Logansport Radiator Equipment Co., Logansport, Ind.
Lonergan Co., J. E., 211 Race St., Philadelphia, Pa.
Long Mfg. Co., Div. Borg-Warner Corp., 12501 Dequendie St., Detroit, Mich.
Lookout Boiler & Mfg. Co., Compress St. & Mfrs. Rd., Chattanooga, Tenn.
Lord Mfg. Co., 1316 Holland St., Erie, Pa.
Lovejoy Tool Wks., 5024 W. Lake St., Chicago, Ill.
Ludlow Valve Mfg. Co., Foot of Adams St., Troy, N. Y.
Ludlum Steel Co., Watervliet, N. Y.
Lukens Steel Co., 104 S. First Ave., Coatesville, Pa.
Lumsden Van Stone Co., 426 First St., South Boston, Mass.
Lunkenheimer Co., Waverly & Beekman Sts., Cincinnati, O.
Luzerne Rubber Co., Muirhead Ave., Trenton, N. J.
Lycoming Mfg. Co., Williamsport, Pa.
Lynchburg Foundry Co., Peoples Bank Bldg., Lynchburg, Va.
Lyon, Conklin & Co., Inc., McComas & Race Sts., Baltimore, Md.
Lytton Mfg. Corp., 102 First Ave., Franklin, Va.

M

Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J.
Magirl Foundry & Furnace Wks., P. H., 413 E. Oakland Ave., Bloomington, Ill.
Maid-O-Mist, Inc., 180 N. Wacker Dr., Chicago, Ill.
●Malleable Iron Fittings Co., Branford, Conn.
Mallory Sales Co., 13904 Lincoln Ave., Dolton, Ill.
Manhattan Rubber Mfg., Div. of Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Manitowoc Boiler Wks., 16th & The River, Manitowoc, Wis.
Manley Products Corp., State & Hay Sts., York, Pa.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
Manufacturers Fin Coil Co., 2505-7 S. Pulaski Rd., Chicago, Ill.
Manufacturers Machine Co., Railroad Ave., North Andover, Mass.
Maple Valley Mfg. Co., First St., Mapleton, Ia.
Marathon Electric Mfg. Corp., Plumer's Island, P. O. 440, Wausau, Wis.
Marathon Oil Co., Tulsa, Okla.
Marble-Card Electric Co., Gladstone, Mich.
Marion Machine Foundry & Supply Co., P. O. Box 685, 3rd and Big Four Ry., Marion, Ind.
Mark & Co., Clayton 20 N. Wacker Drive, Chicago, Ill.
●Marley Co., 1915 Walnut St., Kansas City, Mo.
Marlo Coil Co., 6135 Manchester Ave., St. Louis, Mo.
Marquette Mfg. Co., 401 Johnson St., Minneapolis, Minn.
Marsh Corp., Jas. P., 2073 Southport Ave., Chicago, Ill.
Marsh Tritrol Co., 720 N. Michigan Ave., Chicago, Ill.
Marsh Valve Co., 4th St. & Brigham Rd., Dunkirk, N. Y.
Marshalltown Mfg. Co., 901 E. Nevada, Marshalltown, Ia.
Martin & Sons, H. P., 801 W. 12th St., Owensboro, Ky.
Martin-Parry Corp., W. Market St., York, Pa.
Martocello & Co., Jos. A., 229 N. 13th St., Philadelphia, Pa
Masonite Corp., 111 W. Washington St., Chicago, Ill.
Mason-Neilan Regulator Co., 1190 Adams St., Boston, Mass
Master Electric Co., 100 Davis Ave., Dayton, O.
Master Welders, 2524 Holmes St., Kansas City, Mo.
Matthiesen & Hegeler Zinc Co., 9th & Sterling Sts., La Salle, Ill.
Mauck Seamless Copper Tank Co., Victor, 309 E. Main, Norristown, Pa.
Maurath, Inc., 7309 Union Ave., Cleveland, O.
Maxim Silencer Co., 410 Asylum St., Hartford, Conn.
Maxweld Corp., 140 13th St., Brooklyn, N. Y.
Mayflower-Lewis Corp., E. 7th St. at Duluth, St. Paul, Minn.
Mayson Mfg. Co., Inc., 4332 Horatio St., Detroit, Mich.
Maysteel Products, Inc., Mayville, Wis.
McAlear Mfg. Co., 1901-1909 S. Western Ave., Chicago, Ill.
McAuley Automatic Trap Co., Imperial Power Bldg., Pittsburgh, Pa.
McClave-Brooks Co., Poplar & Park Sts., Scranton, Pa.
McCord Radiator & Mfg. Co., 2587 E. Grand Blvd., Detroit, Mich.
McCorkle Co., D. H., 6th & Bancroft Way, Berkeley, Cal.
McCormick & Co., J. H., Foot of Susquehanna St., Williamsport, Pa.
McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill.
McGowan Co., John H., 54-58 Central Ave., Cincinnati, O.
●McQuay, Inc., 1600 Broadway, N. E., Minneapolis, Minn.
McWane Cast Iron Pipe Co., 1201 Vanderbilt Rd., Birmingham, Ala.

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●Mears-Kane-Ofeldt, Inc., 1903-1915 E. Hagert St., Philadelphia, Pa.
Mechanical Air, 801 Thomas St., Little Rock, Ark.
Medart Co., 3500 DeKalb, St. Louis, Mo.
Meier Electric & Machine Co., 3525 E. Washington St., Indianapolis, Ind.
Mellish & Murray Co., 1715 Carroll Ave., Chicago, Ill.
Merchant & Evans Co., 2035 Washington Ave., Philadelphia, Pa.
Mercoid Corp., 4201 Belmont Ave., Chicago, Ill.
Merco-Nordstrom Valve Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Merrell Mfg. Co., 644 Curtis St., Toledo, O.
Metalace Corp., 60 K St., South Boston, Mass.
Metallo Gasket Co., 16 Bethany St., New Brunswick, N. J.
Metals Coating Co. of America, 495 N. 3rd St., Philadelphia, Pa.
Metropolitan Refining Co., Inc., 23-28 50th Ave., Long Island City, N. Y.
Mettler Co., Lee B., 406 S. Main St., Los Angeles, Cal.
Meyer & Bro. Co., F., 1313 S. Adams St., Peoria, Ill.
Michigan Pipe Co., 503 Phoenix Bldg., Bay City, Mich.
Micro Switch Corp., 1 E. Spring St., Freeport, Ill.
Micro-Westco, Inc., Bettendorf Office Bldg., Bettendorf, Ia.
Mid-Continent Petroleum Corp., Tulsa, Okla.
●Midwest Piping & Supply Co., 1450 Second St., St. Louis, Mo.
Milburn Co., Alexander, 1420 W. Baltimore St., Baltimore, Md.
Miller & Connell Co., 1454-56 N. Claremont Ave., Chicago, Ill.
Miller Electric Mfg. Co., 905 N. Meade St., Appleton, Wis.
Miller Rubber Co., Inc., 1247 S. High St., Akron, O.
Millers Falls Co., 57 Wells St., Greenfield, Mass.
Mills Novelty Co., 4110 W. Fullerton Ave., Chicago, Ill.
Milwaukee Reliance Boiler Wks., 2784 N. 32nd St., Milwaukee, Wis.
●Milwaukee Valve Co., Chase & Burrell Sts., Milwaukee, Wis.
Mineral Felt Co., 2288 Albion St., Toledo, O.
Mineral Insulation Co., 103rd & Southwest Highway, Chicago Ridge, Ill.
●Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., South, Minneapolis, Minn.
Mitchell Moulding Co., 1501-15 Circle Ave., Forest Park, Ill.
Modine Mfg. Co., 17th St., Racine, Wis.
Modern Engineering Co., 3411 Pine Blvd., St. Louis, Mo.
Moeller Instrument Co., 132nd St. & 89th Ave., Richmond Hill., N. Y.
Mojonnier Bros. Co., 4601 W. Ohio St., Chicago, Ill.
Molby Boiler Co., 420 Lexington Ave., New York, N. Y.
Molock Foundry & Machine Co., Kaukauna, Wis.
Monarch Mfg. Works, Inc., Salmon & Westmoreland Sts., Philadelphia, Pa.
Monarch Metal Weatherstrip Co., 6333 Etzel Ave., St. Louis, Mo.
Monash-Younker Co., 1315 W. Congress St., Chicago, Ill.
Moncrief Furnace Co., P. O. Box 1673, Atlanta, Ga.
Monitor Controller Co., 51 S. Gay St., Baltimore, Md.
Monmouth Products Co., 1929-40 E. 61st St., Cleveland, O.
Montag Stove & Furnace Wks., 2011 N. Columbia Blvd., Portland, Ore.
Montgomery Bros., 61 Fremont St., San Francisco, Cal.
Moore Steam Turbine Corp., Wellsville, N. Y.
Moran Flexible Steam Joint Co., 217 W. Main St., Louisville, Ky.
Morehead Mfg. Co., 4895 Grand River Ave., Detroit, Mich.
Morey & Jones, Ltd., 922 S. Hemlock St., Los Angeles, Cal.
Morris Machine Wks., 50 E. Genesee St., Baldwinsville, N. Y.
Morse Chain Co., Turner Pl., Ithaca, N. Y.
Mortell Co., J. W., 310 S. Michigan Ave., Chicago, Ill.
●Motor Equipment Co., 214 W. Douglas, Wichita, Kans.
Mountain States Equipment Co., 1238 Speer Blvd., Denver, Colo.
●Mueller Brass Co., Lapeer Ave., Port Huron, Mich.
Mueller Co., Decatur, Ill.
Mueller Furnace Co., L. J., 2005 W. Oklahoma Ave., Milwaukee, Wis.
Mueller Steam Specialty Co., Inc., 351 W. 26th St., New York. N. Y.
Mullins Mfg. Corp., 1021 Mill St., Salem, O.
Multi-Seal Mfg. Co., 123 N. Jefferson St., Chicago, Ill.
Muncie Gear Wks., Inc., Muncie, Ind.
●Mundet Cork Corp., 450 7th Ave., New York, N. Y.
Murdock Mfg. & Supply Co., 426-30 Plum St., Cincinnati, O.
Murray Iron Wks. Co., 1106 Washington St., Burlington, Ia.
Murray Mfg. Co., D. J., Wausau, Wis.
Myers & Bro. Co., F. E., Ashland, O.
Myers Electric Co., 410 Third Ave., Pittsburgh, Pa.

N

●Nash Engineering Co., South Norwalk, Conn.
Nash Refrigeration Co., Inc., Summit, New and Bleeker Sts., Newark, N. J.
Nason Co., 1050 Mt. Elliot Ave., Detroit, Mich.
National Air Conditioning & Engineering Corp., 109 W. 18th St., Kansas City, Mo.
National Airoil Burner Co., Inc., 1327 Girard Ave., Philadelphia, Pa.
National Aluminate Corp., 6621 W. 66th Pl., Chicago, Ill.
National Boiler Improvement Co., 4100 Georgia Ave., Washington, D. C.
National Fan & Blower Corp., Subsidiary of U. S. Air Conditioning Corp., 2101 Kennedy St., N. E., Minneapolis, Minn.
National Gypsum Co., Delaware Ave., Buffalo, N. Y.
National Laboratories, Inc., 501 Statler Bldg., Boston, Mass.
National Lead Co., 111 Broadway, New York, N. Y.
National Machine Wks., Peoples Gas Bldg., Chicago, Ill.
National Metal Products Corp., 21 N. Sheldon St., Chicago, Ill.
National Meter Co., 4221 First Ave., Brooklyn, N. Y.
●National Pipe Bending Co., 122 River St., New Haven, Conn.
National Radiator Corp., 221 Central Ave., Johnstown, Pa.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Mfg.: 2301 N. Knox Ave., Chicago, Ill. Sales: 2701 Fourth Ave., S., Minneapolis, Minn.
National Steam Pump Co., 701 W. Johnson St., Upper Sandusky, O.
National Steel Corp., Grant Bldg., Pittsburgh, Pa.
●National Tube Co., 1802 Frick Bldg., Pittsburgh, Pa.
National Valve & Mfg. Co., 3101 Liberty Ave., Pittsburgh, Pa.
Naugatuck Mfg. Co., Union City, Conn.
Naylor Pipe Co., 1230 E. 92nd St., Chicago, Ill.
Neemes Foundry, Inc., 216 First St., Troy, N. Y.
Nelson Co., 2604 Fourth Ave., Detroit, Mich.
Nelson Corp., Herman, 1824 Third Ave., Moline, Ill.
Nelson Mfg. Co., B. F., Corner Main & Marshall Sts., N. E. Minneapolis, Minn.
Neptune Meter Co., 50 W. 50th St., New York, N. Y.
●Nesbitt, Inc., John J., & Buckeye Blower Co.,, State Rd. & Rhawn St., Philadelphia, Pa.
New Albany Machine Mfg. Co., E. 10th & Water Sts., New Albany, Ind.
New Departure Div., General Motors Corp., Bristol, Conn.
New Haven Copper Co., Seymour, Conn.
New Jersey Zinc Sales Co., Front & Fletcher Sts., New York, N. Y.
Newman Brothers, Inc., 666 W. Fourth St., Cincinnati, O.
Newport Rolling Mill Co., Ninth & Lowell Sts., Newport, Ky.
New York Air Valve Corp., 476 Broome St., New York, N. Y.
New York Blower Co., 3155 Shields Ave., Chicago, Ill.
New York Brass Foundry, 405 Broome St., New York, N. Y.
Niagara Blower Co., 6 E. 45th St., New York, N. Y.
Niagara Machine & Tool Wks., 637-697 Northland Ave., Buffalo, N. Y.
Nicholson & Co., W. H., 12 Oregon St., Wilkes-Barre, Pa.
Niles Rolling Mill Co., Niles, O.
Norge Heating & Conditioning Div., Borg-Warner Corp. 670 E. Woodbridge St., Detroit, Mich.
Norgren Co., Inc., C. A., Denver, Colo.
●Norma-Hoffmann Bearings Corp., Stamford, Conn.
Norristown Magnesia & Asbestos Co., Washington St., Norristown, Pa.
North American Mfg. Co., 2910 E. 75th, Cleveland, O.
Northern Blower Co., 6409 Barberton Ave., Cleveland, O.
Northern Equipment Co., 1945 Grove Drive, Erie, Pa.
Northern Indiana Brass Co., 935 Plum St., Elkhart, Ind.
Northern Weatherstrip Co., 367 S. First Ave., E., Duluth Minn.
Northwestern Chemical Co., 104 State St., Marietta, O.
Norwalk Co., Inc., Water St., S. Norwalk, Conn.
Norwood Engineering Co., Florence, Mass.
Nugent Sons, Inc. Thos., 223 E. 80th St., New York, N. Y.
Nu-Way Corp., 2416-4th Ave., Rock Island, Ill.
Nye Tool & Machine Wks., 4120-30 Fullerton Ave., Chicago Ill.

O

Oakite Products, Inc., 22 Thames St., New York, N. Y.
Oberdorfer Brass Co., M. L., 2307 Thompson Rd., Syracuse N. Y.
Ohio Brass Co., N. Main St., Mansfield, O.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Works & Foundry Co., Eureka Valve Div. 2735 Colerain Ave., Cincinnati, O.
Ohio Pipe Bending & Machine Co., 3900-3910 Trent Ave. Cleveland, O.
Ohio Products Co., 4158 Rustic Rd., Cleveland, O.
Ohio Welder Co., Middlefield, O.
Ohl & Son, George A., 159 Oraton St., Newark, N. J.
Oil Well Supply Co., Oil City, Pa.
Orr & Sembower, Inc., Box 817, Reading, Pa.
Oster Mfg. Co., 2057 E. 61st Pl., Cleveland, O.
Otis Steel Co., 3341 Jennings Rd., Cleveland, O.
Owen-Dyneto Corp., Syracuse, N. Y.
●Owens-Illinois Glass Co., Ohio Bldg., Toledo, O.

P

Pacific Lumber Co., 102 Bush St., San Francisco, Cal.
Pacific Steel Boiler Div., United States Radiator Corp., 1056 First National Bank Bldg., Detroit, Mich.
Page Steel & Wire, Div. of American Chain Co., Inc., Monessen, Pa.
Paine Co., 2951 W. Carroll Ave., Chicago, Ill.
Pains Fireworks Display Co., 22 Park Pl., New York, N. Y.
Palmer Co., 2501 Norwood Ave., Cincinnati (Norwood), O.
Palmer Electric Co., 1258 Park Pl., Detroit, Mich.
"Pamco" Conditionaire Co., 4223 W. Lake St., Chicago, Ill.
Pangborn Corp., Pangborn Blvd., Hagerstown, Md.
Paragon Electric Co., 37 W. Van Buren St., Chicago, Ill.

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Paragon Kol-Master Corp., Oregon, Ill.
Parker Appliance Co., 17325 Euclid Ave., Cleveland, O.
Parker-Kalon Corp., 200 Varick St., New York, N. Y.
Parks-Cramer Co., 970 Main St., Fitchburg, Mass.
Parsons, John R., 151 E. 19th St., New York, N. Y.
Patterson Foundry & Machine Co., East Liverpool, O.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Patterson Shade Co., 1525 N. Meridian St., Indianapolis, Ind.
Payne Furnace & Supply Co., Inc., 336-338 N. Foothill Rd., Beverly Hills, Cal.
Peabody Engineering Corp., 580 Fifth Ave., New York, N. Y.
Peck, Stow & Wilcox Co., Center St., Southington, Conn.
Pecora Paint Co., 4th & Penna. R. R., Philadelphia, Pa.
Peerless of America, Inc., 515 W. 35th St., Chicago, Ill.
Peerless Electric Co., 1401 W. Market St., Warren, O.
Peerless Machine Co., 1615 Racine St., Racine, Wis.
●Peerless Pump Div., Food Machinery Corp., 300 Walnut Rd., Massillon, O.
Peerless Unit Ventilation Co., Inc., 810 Union Ave., Bridgeport, Conn.
Pels & Co., Inc., Henry, 90 West St., New York, N. Y.
Penberthy Injector Co., 1242 Holden Ave., Detroit, Mich.
Penn Cooling Tower Wks., 1337 Nixon St., Pittsburgh, Pa.
Penn Electric Switch Co., Box 556, Goshen, Ind.
Penn Mfg. Corp., of Washington, Pa., 380 W. Chestnut St., P. O. Box 484, Washington, Pa.
Pennsylvania Engineering Wks., 526 S. Jefferson St., New Castle, Pa.
Pennsylvania Forge Co., Milnor & Bleigh Sts., Philadelphia, Pa.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Perfection Grate & Stoker Co., 4 Fisk Ave., Springfield, Mass.
Perfection Refrigeration Parts Co., Harvey, Ill.
Perfex Corp. (Controls Div.), 415 W. Oklahoma Pl., Milwaukee, Wis.
Perfex Corp. (Unit Heater Div.), 415 W. Oklahoma Pl., Milwaukee, Wis.
Perkins & Son, Inc., B. F., Chicopee St., Holyoke, Mass.
Permutit Co., 330 W. 42nd St., New York, N. Y.
Petroleum Heat & Power Co., 110 Davenport St., Stamford, Conn.
Petrometer Corp., 1 Star Sq., Long Island City, N. Y.
Pfaudler Co., 89 East Ave., Rochester, N. Y.
Pfening Co., Fred D., 1075 W. 5th Ave., Columbus, O.
Phelps Dodge Copper Products Corp., British American Tube Div., 40 Wall St., New York, N. Y.
Philadelphia Gear Co., Erie Ave. & G St., Philadelphia, Pa.
Philadelphia Pipe Bending Co., 4135-65 N. Fifth St., Philadelphia, Pa.
Philadelphia Thermometer Co., 915 Filbert St., Philadelphia, Pa.
Phoenix Brass Fittings Corp., Coit St. & Chancellor Ave., Irvington, N. J.
Phoenix Ice Machine Co., 2711 Church St., Cleveland, O.
Pierce Butler Radiator Corp., 701 Nichols Ave., Syracuse, N. Y.
Pierce Co., Wm. B., 45 N. Division St., Buffalo, N. Y.
Pioneer Air Conditioning Corp., 1300 Stevens Ave., Minneapolis, Minn.
Pioneer Heat Regulator Corp., 100 Davis Ave., Dayton, O.
Pioneer Roofing & Sheet Metal Co., 226 N. Main St., Muskogee, Okla.
●Pipe Fabrication Institute, 1108 Clark Bldg., Pittsburgh, Pa.
Pittsburgh Brass Mfg. Co., 3155 Penn Ave., Pittsburgh, Pa.
Pittsburgh Equitable Meter Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Pittsburgh Lectrodryer Corp., P. O. Box 1008, Pittsburgh, Pa.
Pittsburgh Pipe Coil & Bending Co., 59 Bridge St., Etna, Pa.
Pittsburgh Piping & Equipment Co., 43rd St. & A. V. R. R., Pittsburgh, Pa.
Pittsburgh Steel Co., Union Trust Bldg., Pittsburgh, Pa.
Pittsburgh Tube Co., Vandergrift Bldg., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Pittsburgh Valve Foundry & Construction Co., 26th St. & Allegheny Valley R. R., Pittsburgh, Pa.
Pittsburgh Water Heater Co., Box 1109, Pittsburgh, Pa.
Pleasantaire Corp., 1623 Connecticut Ave., Washington, D. C.
Plummer Spray Equipment Co., 700 Filmore St., Napoleon, O.
Plymouth Cordage Co., Court St., N. Plymouth, Mass.
Polar Air, Inc., 100 N. Ewing, Dallas, Texas.
●Pomona Pump Co., 206 E. Commercial St., Pomona, Cal.; 53 W. Jackson Blvd., Chicago, Ill.
Poole Foundry & Machine Co., 3730 Clipper Mill Rd., Woodberry, Baltimore, Md.
●Porter & Co., Inc., H. W., 825 Frelinghuysen Ave., Newark, N. J.
Powell Co., Wm., 2525 Spring Grove Ave., Cincinnati, O.
Power Piping Co., 829 Beaver Ave., Pittsburgh, Pa.
●Powers Regulator Co., 2720 Greenview Ave., Chicago, Ill.
●Practical Instrument Co., 2717 N. Ashland Ave., Chicago, Ill.
Presstite Engineering Co., 3900 Chauteau St., St. Louis, Mo.
Pressure Oil Burners, Inc., 55 N. Broad St., York, Pa.
Propellair, Inc., 1345 Lagonda Ave., Springfield, O.
Prox Co., Frank, 1201 S. First St., Terre Haute, Ind.
Public Works Supply Co., 93 Brookline St., Lynn, Mass.
Pure Carbonic, Inc., Lincoln Bldg., New York, N. Y.
Pyott Foundry & Machine Co., 328 N. Sangamon St., Chicago, Ill.
Pyrometer Instrument Co., 103 Lafayette St., New York, N. Y.

Q

Quaker City Iron Wks., Allegheny & Tulip Sts., Philadelphia, Pa.
Quimby Pump Co., Inc., 340 Thomas St., Newark, N. J.

R

Radiator Specialty Co., Charlotte, N. C.
Rafter Machine Co., 259 Stephens St., Belleville, N. J.
Raisler Sprinkler Co., 129 Amsterdam Ave., New York, N. Y.
Ramsay Chain Co., Inc., 1029 Broadway, Albany, N. Y.
Ranco, Inc., 601 W. 5th Ave., Columbus, O.
●Randall Graphite Products Corp., 609 W. Lake St., Chicago, Ill.
Ravena Iron Co., Ravena, N. Y.
Rawlplug Co., Inc., 98 Lafayette St., New York, N. Y.
Ray Oil Burner Co., 401-499 Bernal Ave., San Francisco, Cal.
Raymond Co., F. I., 629 Washington Blvd., Chicago, Ill.
Reading Iron Co., 401 N. Broad St., Philadelphia, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.
Red Jacket Pump Co., Davenport, Ia.
Redi Automatic Coal Burners, Inc., N. 107 Freyar St., Spokane, Wash.
Reed Steam Equipment Co., 136 Fairfield Ave., Bridgeport, Conn.
Reed Unit-Fans, Inc., 811 St. Charles St., New Orleans, La.
Reeves Steel & Mfg. Co., Dover, O.
Refinite Corp., Refinite Bldg., Omaha, Neb.
Refractory & Insulation Corp., 381 Fourth Ave., New York, N. Y.
●Refrigeration & Air-Conditioning Institute, Inc., 2130-2158 Lawrence Ave., Chicago, Ill.
Refrigeration Appliances, Inc., 917-923 W. Lake St., Chicago, Ill.
Rega Mfg. Co., 79 Mt. Hope Ave., Rochester, N. Y.
Register & Grille Mfg. Co., Inc., 70 Berry St., Brooklyn, N. Y.
Reichert Float & Mfg. Co., 2238 Smead Ave., Toledo, O.
Reif-Rexoil, Inc., 37-41 Carroll St., Buffalo, N. Y.
Reliance Electric & Engineering Co., Ivanhoe Rd., Cleveland, O.
Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland, O.
Reliance Refrigerating Machine Co., 3401 N. Kedzie Ave., Chicago, Ill.
●Rempe Co., 340 N. Sacramento Blvd., Chicago, Ill.
Rensaeller Valve Co., Ontario St., Cohoes, N. Y.
Republic Flow Meters Co., 2240 Diversey Pkwy., Chicago, Ill.
Republic Rubber Co., Youngstown, O.
● Republic Steel Corp., Republic Bldg., Cleveland, O.
●Research Corp., Chrysler Bldg., New York, N. Y.
Resisto Pipe & Valve Co., 262 Bridge St., East Cambridge, Mass.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Revolving Doors, Inc., 542 W. 27th, New York, N. Y.
Rex Clay Products Co., 14413 Dexter Blvd., Detroit, Mich.
Reynolds Corp., 19 Rector St., New York, N. Y.
Reznor Mfg. Co., Mercer, Pa.
Rhoads & Sons, J. E., 11th & B. & O. R. R., Wilmington, Del.
Rhode Island Fittings Co., Hillsgrove, R. I.
Rhode Island Humidifier & Ventilating Co., 99 Chauncy St., Boston, Mass.
Rhodes, Inc, M. H., 9 Rockefeller Plaza, New York, N. Y.
Richardson & Boyton Co., 244 Madison Ave., New York, N. Y.
Richmond Engineering Co., 1305 Brook Ave., Richmond, Va.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
●Ric-wiL Co., 1562 Union Trust Bldg., Cleveland, O.
●Ridge Tool Co., Box 670, Elyria, O.
Riley Stoker Corp., 9 Neponset St., Worcester, Mass.
Ripley Co., W. R., 318 N. E St., Tacoma, Wash.
Riverside Boiler Wks., Inc., 50 Harvard St., Cambridge, Mass.
Robbins & Myers, Inc., Lagonda Ave., Springfield, O.
Roberts-Gordon Appliance Corp., 137 Arthur St., Buffalo, N. Y.
Robertson Co., H. H., 2000 Grant Bldg., Pittsburgh, Pa.
Rock Island Register Co., 2435 Fifth Ave., Rock Island, Ill.
Rock Products Co., 150 Fourth Ave., N., Nashville, Tenn.
Rockwood Mfg. Co., 1801-2001 English Ave., Indianapolis, Ind.
Rockwood Sprinkler Co., 38 Harlow St., Worcester, Mass.
Rock Wool Products Co., P. O. Box 276, Wabash, Ind.
Roebling's Sons, John A., South Broad St., Trenton, N. J.
Roessing Mfg. Co., 1616 Noble St., Sharpsburg Sta., Pittsburgh, Pa.
Roller Bearing Co. of America, Whitehead Rd., Trenton, N. J.
Rome-Turney Radiator Co., Canal St., Rome, N. Y.
Roots-Connersville Blower Corp., 16th St. & Columbia Ave., Connersville, Ind.
Roper Corp., Geo. D., Blackhawk Ave., Rockford, Ill.
Rosedale Foundry & Machine Co., Columbus & Preble Aves., N. S., Pittsburgh, Pa.
Ross Engineering Corp., J. O., 350 Madison Ave., New York, N. Y.
Ross Heater & Mfg. Co., Inc., 1407 West Ave., Buffalo, N. Y.
Ross Sprinkler Co., 34 Roberts St., Pasadena, Cal.
Ross Valve Mfg. Co., Inc., 6 Oakwood Ave., Troy, N. Y.
Rotary Mfg. Co., 5718 Long Beach Ave., Los Angeles, Cal.

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Rotary Seal Co., 809 W. Madison St., Chicago, Ill.
Royal Ventilator Co., 415 Locust St., Philadelphia, Pa.
Royersford Foundry & Machine Co., Inc., Royersford, Pa.
R-S Products Corp., Germantown Ave., at Wayne Junction, Philadelphia, Pa.
Ruberoid Co., 500 Fifth Ave., New York, N. Y.
Ruby Chemical Co., 74 McDowell St., Columbus, O.
Ruggles-Klingemann Mfg. Co., 4 Foster Ct., Salem, Mass.
Rumsey Pump Corp., Seneca Falls, N. Y.
Russell & Co., W. A., Rm. 1734, Grand Central Terminal Bldg., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Russell Electric Co., 348 W. Huron St., Chicago, Ill.
Russell Insulation Co., F. C., 3925 S. Hanover St., Baltimore, Md.
Ruud Mfg. Co., 2934 Smallman St., Pittsburgh, Pa.
R. U. V. Engineering Corp., 110 E. 42nd St., New York, N. Y.

S

●St. Louis Blow Pipe & Heater Co., 1954 N. 9th St., St. Louis, Mo.
Sales & Co., Murray W., 801 W. Baltimore Ave., Detroit, Mich.
Sall Mountain Co., 176 W. Adams St., Chicago, Ill.
Sangamo Electric Co., 1301 N. 11th St., Springfield, Ill.
●Sarco Co., Inc., 183 Madison Ave., New York, N. Y.
Sauereisen Cements Co., 2308 Main St., Sharpsburg, Pa.
Saunders Sons, Inc., D., 25 Atherton St., Yonkers, N. Y.
Scaife & Sons Co., Wm. B., 26 Ann St., Oakmont, Pa.
Schade Valve Mfg. Co., 2527 N. Bodine St., Philadelphia, Pa.
Schaphorst, W. F., 45 Academy St., Newark, N. J.
Schatz Mfg. Co., Fairview, Poughkeepsie, N. Y.
Schatz Venetian Blinds, Los Angeles, Cal.
Schaub Engineering Co., Fred H., 325 W. Huron St., Chicago, Ill.
Schneible Co., Claude B., 3951 Lawrence Ave., Chicago, Ill.
Schoedinger, F. O., 322-358 Mt. Vernon Ave., Columbus, O.
Schramm, Inc., West Chester, Pa.
Schubert-Christy Corp., Box 166, Affton Station, St. Louis, Mo.
Schundler & Co., Inc., F. E., 45-15 Vernon Blvd., Long Island City, N. Y.
Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia, Pa.
Schwitzer-Cummins Co., Fan St., Indianapolis, Ind.
Scientific Instrument Co., 531-35 W. Larned, Detroit, Mich.
Scott-Newcomb, Inc., 1922 Pine St., St. Louis, Mo.
Scott Valve Mfg. Co., 3963 McKinley Ave., Detroit, Mich.
Scovill Mfg. Co., 99 Mill Street, Waterbury, Conn.
Sealkote Corp., 40 S. Clinton St., Chicago, Ill.
Seamlex Co., 5-18 48th Ave., Long Island City, N. Y.
Self-Vulcanizing Rubber Co., Inc., 605 W. Washington Blvd., Chicago, Ill.
Semans & Sons, Geo. G., 416 Lyceum Bldg., Pittsburgh, Pa.
Semet-Solvay Engineering Corp., 40 Rector St., New York, N. Y.
Semler Co., Jeannette, Pa.
Seneca Wire & Mfg. Co., Fostoria, O.
Servel, Inc., 119 Morton Ave., Evansville, Ind.
Shafer Bearing Corp., 35 E. Wacker Dr., Chicago, Ill.
Shallcross Controls, Inc., 121 N. Broadway, Milwaukee, Wis.
Shank, Cyrus, 625 W. Jackson Blvd., Chicago, Ill.
Sharon Steel Corp., Sharon, Pa.
Shaw Co., Benjamin F., Second & Lombard Sts., Wilmington, Del.
Shaw-Kendall Engineering Co., 120-130 S. Superior St., Toledo, O.
Shaw-Perkins Mfg. Co., Oliver Bldg., Pittsburgh, Pa.
Sheer Co., H. M., Second & Hampshire Sts., Quincy, Ill.
Sight Feed Generator Co., 14-18 N. 10th St., Richmond, Ind.
Silent Glow Oil Burner Corp., 1477 Park St., Hartford, Conn.
Simplex Heating Specialty Co., Inc., Peoples Bank Bldg., Lynchburg, Va.
Simplex Oil Heating Corp., 30 Church St., New York, N. Y.
Sims Co., 18th & Whitley Sts., Erie, Pa.
Sinclair Refining Co., 45 Nassau, New York, N. Y.
Sinker-Davis Co., 230 S. Missouri St., Indianapolis, Ind.
SKF Industries, Inc., Front St. & Erie Ave., Philadelphia, Pa.
Skidmore Corp., St. Joseph, Mich.
Skilsaw, Inc., 3310 N. Elston Ave., Chicago, Ill.
Skinner Co., M. B., South Bend, Ind.
Skinner Engine Co., 337 W. 12th St., Erie, Pa.
Skinner Irrigation Co., 1212 E. Canal St., Troy, O.
Slater Mfg. Co., 24 Water St., Wakefield, Mass.
Sly Mfg. Co., W. W., 4700 Train Ave., Cleveland, O.
Smidth & Co., F. L., 225 Broadway, New York, N. Y.
Smith Co., H. B., 57 Main, Westfield, Mass.
Smith Heater Co., Peter, 6209 Hamilton St., Detroit, Mich.
Smith, Inc., James Campbell, rear of 1679 Collamer Rd., Cleveland, O.
Smith, Inc., Winfield H., Eaton St., Springville, N. Y.
Smith & Kanzler, Inc., 516-534 Lidgerwood Ave., Elizabeth, N. J.
Smith Twin Tubular Boiler Co., Inc., Cottman St. at State Rd., Philadelphia, Pa.
Smith Welding Equipment Co., 2633 S. E. Fourth St., Minneapolis, Minn.
Smolensky Valve Co., Inc., 1931 W. 47th St., Cleveland, O.
Smooth-On Mfg. Co., 568-574 Communipaw Ave., Jersey City, N. J.
Snap-On Tools, Inc., Kenosha, Wis.
Snead, Herbert S., 205 E. 42nd St., New York, N. Y.
Somers, Inc., H. J., 6063 Wabash Ave., Detroit, Mich.
Somerville Iron Wks., Somerville, N. J.
South Chester Tube Co., Front & Thurlow Sts., Chester, Pa.
Southworth Machine Co., 30 Warren Ave., Portland, Me.
Spang-Chalfant, Inc., Grant Bldg., Pittsburgh, Pa.
Spear Stove & Heating Co., James, 1823 Market St., Philadelphia, Pa.
Specialty Converters, Inc., 161 E. Erie St., Chicago, Ill.
Speedway Mfg. Co., 1834 S. 52nd Ave., Chicago (Cicero), Ill.
Spence Engineering Co., Inc., 32 Grant St., Walden, N. Y.
Spencer Heater Div., Lycoming Mfg. Co., 652 Oliver St., Williamsport, Pa.
Spencer Thermostat Co., 43 Forest St., Attleboro, Mass.
Spencer Turbine Co., 486 New Park Ave., Hartford, Conn.
Spoehrer-Lange Co., 3723 Commonwealth St., St. Louis, Mo.
Spray Engineering Co., 114 Central St., Somerville, Mass.
Sprayo-Flake Co., 2715 Irving Park Blvd., Chicago, Ill.
Sprout-Waldron & Co., Muncy, Pa.
Square D Co., 6060 Rivard St., Detroit, Mich.
Squires Co., C. E., E. 4th St. & Keeley Ave., Cleveland, O.
Standard Air Conditioning, Inc., 40 W. 40th St., New York, N. Y.
Standard Asbestos Mfg. Co., 820-822 W. Lake St., Chicago, Ill.
Standard Auto-Tite Joint Co., 7501 Thomas Blvd., Pittsburgh, Pa.
Standard Engineering Wks., 289 Roosevelt Ave., Pawtucket, R. I.
Standard Galvanizing Co., 2611-2619 W. Van Buren St., Chicago, Ill.
Standard Lime and Stone Co., 2004 First National Bank Bldg., Baltimore, Md.
Standard Oil Co., of California, 225 Bush, San Francisco, Cal.
Standard Oil Co. of Indiana, 910 S. Michigan Ave., Chicago, Ill.
Standard Products Co., Fisher Bldg., Detroit, Mich.
Standard Thermometer, Inc., 65 Shirley St., Boston, Mass.
Standard Union Co., 71 Gooding St., Lockport, N. Y.
Stanley Wks., 195 Lake St., New Britain, Conn.
Staples & Pfeiffer, Ltd., 528 Bryant St., San Francisco, Cal.
Star Brass Mfg. Co., 108 E. Dedham St., Boston, Mass.
Star Electric Motor Co., 197 Grove St., Bloomfield, N. J.
Star Expansion Bolt Co., 147 Cedar St., New York, N. Y.
Star Mfg. Co., Inc., 530 Kinsley Ave., Providence, R. I.
Star Products Co., 554 E. 141st St., New York, N. Y.
Star Radiator Co., 649 Ceres Ave., Los Angeles, Cal.
Starbuck & Sons, Inc., R. M., P. O. Box 1331, Hartford, Conn.
Starr Piano Co., Richmond, Ind.
●Staynew Filter Corp., 25 Leighton Ave., Rochester, N. Y.
Stay-Rite Co., Inc., 1250 W. Fourth St., Cleveland, O.
Steamaire Co., 2436 Reading Rd., Cincinnati, O.
Steel Improvement & Forge Co., 960 Addison Rd., Cleveland, O.
Steel Products Engineering Co., Columbia St. & Dakota Ave., Springfield, O.
Steel and Tubes, Inc., 224 E. 131st St., Cleveland, O.
Steelweld Machinery Co.. E. 70th & Machinery Ave., Cleveland, O.
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Cal.
Sterling Engineering Co., 3738 N. Holton St., Milwaukee, Wis.
Sterling Engineering & Mfg. Corp., 117 Business St., Hyde Park, Mass.
Stevens-Root Co., 51 E. Grand Ave., Chicago, Ill.
Stewart Ice Machine Co., 1046 E. 22nd St., Los Angeles, Cal.
Stickle Steam Specialties Co., 2215 Valley Ave., Indianapolis, Ind.
Stilphen Engineering & Mfg. Co., C. A., 1129 18th St., Denver, Col.
Stockham Pipe & Fittings Co., 4100 Tenth Ave., N., Birmingham, Ala.
Stokermatic Co., 1415 S. State St., Salt Lake City, Utah.
Stokers, Inc., 15231 Kercheval Ave., Detroit, Mich.
Stokes Rubber Co., Jos., Taylor & Webster, Trenton, N. J.
Strandwitz & Co., Inc., 537 S. 2nd St., Camden, N. J.
●Streamline Pipe & Fittings Div., Mueller Brass Co., Lapeer Ave., Port Huron, Mich.
Strong, Carlisle & Hammond Co., 1394 W. Third St., Cleveland, O.
Strong-Scott Mfg. Co., Taft & Kennedy Sts., N. E., Minneapolis, Minn.
Struthers-Wells-Titusville Co., Warren, Pa.
●Sturtevant Co., B. F., Damon St., Hyde Park, Boston, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Superior Sheet Steel Co., Division of Continental Steel Corp., Canton-Louisville Rd., Canton, O.
Super Radiator Corp., 320 Plymouth Bldg., Minneapolis, Minn.
Superstat Co., 38 Walter St., Springfield, Mass.
Supreme Electric Products Corp., 99 Mt. Hope Ave., Rochester, N. Y.
Supreme Heater & Ventilating Corp., 1915 Pine St., St. Louis, Mo.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Swaby Mfg. Co., 2010 Marshall Blvd., Chicago, Ill.
Swartwout Co., 18511 Euclid Ave., Cleveland, O.
Swedish Venetian Blind Co., 601 W. 26th St., New York, N. Y.
Swoboda, Inc., H. O., 13th St., New Brighton, Pa.

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T

Taber Pump Co., 272 Elm St., Buffalo, N. Y.
Taco Heaters, Inc., 342 Madison Ave., New York, N. Y.
Tagliabue Mfg. Co., C. J., 540 Park Ave., Brooklyn, N. Y.
Tallmadge & Co., Webster, 225-255 N. 18th St., East Orange, N. J.
Tatro Bros, Inc., 218 Washington St., Decorah, Ia.
Taylor Engineering Co., Metropole Hotel, Cincinnati, O.
Taylor Forge & Pipe Wks., P. O. Box 485, Chicago, Ill.
Taylor Instrument Companies, 95 Ames St., Rochester, N. Y.
Tecumseh Products Co., Tecumseh, Mich.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Terry Steam Turbine Co., 874 Windsor Ave., Hartford, Conn.
Texas Co., 135 E. 42nd St., New York, N. Y.
Thatcher Co., 39 St. Francis St., Newark, N. J.
Thermal Units Mfg. Co., 70 Britannia St., Meriden, Conn.
Thermax Div., Northwest Magnesite Co., Farmers Bank Bldg., Pittsburgh, Pa.
Therminsul Corp., 1603 Fulford St., Kalamazoo, Mich.
Thermoid Rubber Co., Whitehead Rd., Trenton, N. J.
Thrush & Co., H. A., Peru, Ind.
Thwing-Albert Instrument Co., 3339 Lancaster Ave., Philadelphia, Pa.
Tierney Rotor Ventilator Co., 239 Fourth Ave., S. Minneapolis, Minn.
Timken Roller Bearing Co., 1835 Dueber Ave., S. W. Canton, O.
Timken Steel & Tube Co., Canton, O.
Tippett & Wood, Taylor & Wilson Sts., Phillipsburg, N. J.
Titeflex Metal Hose Co., 500 Frelinghuysen Ave., Newark, N. J.
●Titusville Iron Wks. Co., S. Franklin St., Titusville, Pa.
Todd Combustion Equipment, Inc., Foot 23rd St., Brooklyn, N. Y.
Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo, O.
Torchweld Equipment Co., 1025 W. Lake St., Chicago, Ill.
Tork Clock Co. Inc., 33 South St., Mt. Vernon, N. Y.
Torrey Refrigeration Products, 1000 N. Orange Dr., Los Angeles, Cal.
●Torrington Mfg. Co., 70 Franklin St., Torrington, Conn.
Trageser Steam Copper Wks., John, 5000 Grand St., Maspeth, Long Island, N Y.
●Trane Co., La Crosse, Wis.
Trent Co., Harold E., 618-640 N. 54th St., Philadelphia, Pa.
Trenton Auto Radiator Wks., 626 Brunswick Ave., Trenton, N. J.
Trerice Co., H. O., 1420 W. Lafayette Blvd., Detroit, Mich.
Trimont Mfg. Co., 55-71 Amory St., Roxbury, Boston, Mass.
Trimount Rotary Power Co., 398 Whiting Ave., East Dedham, Mass.
Triox Engineering Co., 207 Board of Education Bldg., St. Louis, Mo.
Triplex Mfg. Co., Peru, Ind.
Triumph **Ice Machine Co., 107-109 E. Front St., Cincinnati,** O.
Troy Engine & Machine Co., Troy, Pa.
Trumbull Electric Mfg. Co., Woodford Ave., Plainville, Conn.
Truscon Steel Co., 1315 Albert St., Youngstown, O.
Tryco Products, Inc., Railroad Sq., Westfield, Mass.
●Tube-Turns, Inc., 224 E. Broadway, Louisville, Ky.
Turner Brass Wks., 823-47 Park Ave., Sycamore, Ill.
Tuthill Pump Co., 131 W. 63rd St., Chicago, Ill.
●Tuttle & Bailey, Inc., Corbin Ave., New Britain, Conn.
XXth Century Heating and Ventilating Co., Cor. Ira & Edison Aves., Akron, O.

U

Uehling Instrument Co., 473 Getty Ave., Paterson, N. J.
Una Welding, Inc., 1615 Collamer Ave., E., Cleveland, O.
Underground Steam Construction Co., 73 Pitts St., Boston, Mass.
Unified Air Conditioner Co., Torry Bldg., Duluth, Minn.
Uniflow **Mfg. Co., E. Lake Rd., Erie, Pa.**
●Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Union Fibre Co., Winona, Minn.
Union Iron Wks., 1500 Cascade St., Erie, Pa.
Union Metal Wks., Inc., 80 Carter St., Chelsea, Mass.
Union Steam Pump Co., Jefferson Ave., Battle Creek, Mich.
Union Water Meter Co., 333 Hermon St., Worcester, Mass.
●Unit Heater & Cooler Co., 1002-1024 Third St., Wausau, Wis.
United American Bosch Corp., 3664 Main St., Springfield, Mass.
United Cork Companies, Central Ave., Kearney, N. J.
United Electric Controls Co., 69 A St., Boston, Mass.
United Metal Hose Co., Inc., 36-01 43rd Ave., Long Island City, N. Y.
United Motors Service Co., General Motors Bldg., Detroit, Mich.
United States Brass & Copper Co., Hyde Park, Boston, Mass.
United States Gauge Co., 44 Beaver St., New York, N. Y.
United States Gypsum Co., 300 W. Adams St., Chicago, Ill.
United States Mineral Wool Co., 9 S. Clinton St., Chicago, Ill.
United States Ozone Co. of America, Crescent St., Scottdale, Pa.
United States Pipe & Foundry Co., Burlington, N. J.
United States Radiator Corp., 1056 National Bank Bldg., Detroit, Mich.
United States Register Co., Burnham St., Battle Creek, Mich.
United States Rubber Products, Inc., 1790 Broadway, New York, N. Y.
●United States Steel Corp., Pittsburgh, Pa.
United Superior Union Co., Inc., 29 Ryerson St., Brooklyn, N. Y.
Universal Air Filter Corp., Duluth, Minn.
●Universal Cooler Corp., Green & Melville Aves., Detroit, Mich.
Universal Gypsum & Lime Co., 105 W. Madison St., Chicago, Ill.
Universal Motor Co., 323 Universal Ave., Oshkosh, Wis.
Universal Power Corp., 4300 Euclid Ave., Cleveland, O.
Uno Ventilator Co., 339 Lincoln Ave., Cliftondale, Mass.
Upson Co., Upson Point, Lockport, N. Y.
●U. S. Air Conditioning Corp., 2101 Kennedy St., N. E., Minneapolis, Minn.
U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles, Cal.
U. S. Electrical Tool Co., 2488-2496 W. 6th St., Cincinnati, O.
U. S. Expansion Bolt Corp., Holland Plaza Bldg., 75 Varick St., New York, N. Y.
U. S. Hame Co., 135 Tonawanda St., Buffalo, N. Y.
U. S. Motors Corp., Oshkosh, Wis.
U. S. Pipe Bending Co., 840 Harrison St., San Francisco, Cal.
U. S. Stoneware Co., 60 E. 42nd St., New York, N. Y.
Utica Products, Inc., 1101 Burrstone Rd., Utica, N. Y.
Utica Radiator Corp., 2201 Dwyer Ave., Utica, N. Y.
Utility Fan Corp., 2528 Santa Fe Ave., Los Angeles, Cal.

V

Vallen, Inc., 225 Bluff, Akron, O.
Vanderman Mfg. Co., Mansfield Ave., Willimantic, Conn.
Vapor Heating Co., 101 W. 42nd St., New York, N. Y.
Van Kannel Revolving Door Co., 101 Park Ave., New York, N. Y.
Ventilating Products Co., 2800 Cottage Grove Ave., Chicago, Ill.
Vento Steel Sash Co., Muskegon, Mich.
Verson Allsteel Press Co., 93rd & Kenwood Ave., Chicago, Ill.
Vibration Eliminator Co., 25-08 37th Ave., Long Island City, N. Y.
Victaulic Co. of America, 26 Broadway, New York, N. Y.
Victor Equipment Co., Kimball-Krogh Pump Div., 1010 E. 62nd St., Los Angeles, Cal.
Vigor-Aire Corp., 127 S. 5th St., Philadelphia, Pa.
Viking Air Conditioning Corp., Main & Center Sts., N. W., Cleveland, O.
Viking Pump Co., Fourth and State Sts., Cedar Falls, Ia.
Viking Shear Co., 1063 W. 19th St., Erie, Pa.
●Vilter Mfg. Co., 2148 S. First St., Milwaukee, Wis.
Vinco Co., Inc., 305 E. 45th St., New York, N. Y.
Virginia Smelting Co., West Norfolk, Va.
Vitreous Enameling & Stamping Co., 1381 Sedgwick Ave., New York, N. Y.
Vogt Machine Co., Henry, 10th & Ormsby Sts., Louisville, Ky.
Voss Co., J. H. H., 408 Concord St., New York, N. Y.
Vulcan Arc Welder Mfg. Co., 2820 Locust St., St. Louis, Mo.
Vulcan Radiator Co., 26 Francis Ave., Hartford, Conn.

W

●Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo.
Wailes Dove-Hermiston Corp., 17 Battery Pl., New York, N. Y.
Waldron Corp., John, New Brunswick, N. J.
Wallace Supplies Mfg. Co., 1310 Diversey Pkwy., Chicago, Ill.
Walsh-Holyoke Steam Boiler Co., Holyoke, Mass.
Walsh-Spencer Co., 400 Boylston St., Boston, Mass.
●Walworth Co., 60 E. 42nd St., New York, N. Y.
Ward Foundry, Inc., J. P., Blossburgh, Pa.
Ward Leonard Electric Co., 37 South St., Mt. Vernon, N. Y.
Ward Machinery Co., 564 W. Washington Blvd., Chicago, Ill.
Warren Electric Appliance Company, Warren Bank & Trust Co. Bldg., Warren, Pa.
Warren Foundry & Pipe Corp., 11 Broadway, New York, N. Y.
Warren Shade Co., Inc., 2905 E. Hennepin Ave., Minneapolis, Minn.
Warren Steam Pump Co., Inc., Warren, Mass.
Washburne & Co., E. G., 207 Fulton St., New York, N. Y.
Water Cooling Tower Co., 605 W. Washington Blvd., Chicago, Ill.
Water Refining Co., 1123 Barthold, Ft. Wayne, Ind.
Waterfilm Boilers, Inc., 154 Ogden Ave., Jersey City, N. J.
●Waterloo Register Co., 2520 E. 4th St., Waterloo, Ia.
Watson & McDaniel Co., 440 N. Marshall, Philadelphia, Pa.
●Watson-Stillman Co., 140 Aldene Rd., Roselle, N. J.
Watts Regulator Co., 10 Embankment St., Lawrence, Mass.
Waukesha Motor Co., Waukesha, Wis.
Way Panel Loctor Co., Wollaston, Mass.
Wayne Oil Burner Corp., 800 Glasgow Ave., Fort Wayne, Ind.
Weatherhead Co., 620 Frankfort St., Cleveland, O.
●**Webster & Co., Warren, 17th & Federal Sts., Camden, N. J.**
Webster Electric Co., Clark & DeKoven Aves., Racine, Wis.
Wedge Protectors, Inc., 9522 Richmond Ave., Cleveland, O.

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Weil-McLain Co., 641 W. Lake St., Chicago, Ill.
Weil Pump Co., 215-17 W. Superior St., Chicago, Ill.
Weinman Pump Co., 290 Spruce St., Columbus, O.
Weirton Steel Co., Weirton, W. Va.
Western Blower Co., 1800 Airport Way, Seattle, Wash.
Western Felt Wks., 4029-4117 Ogden Ave., Chicago, Ill.
Western Furnaces, Inc., 3002 S. Chandler, Tacoma, Wash.
Western Hanger Co., 55 New Montgomery St., San Francisco, Cal.
Western Rotary Ventilator Co., Inc., 1720 E. 14th St., Los Angeles, Cal.
Western Venetian Blind Co., 601 W. 26th St., New York, N. Y.
Western Wire Products Co., 1415-35 S. 18th St., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Westinghouse Electric & Mfg. Co., Mansfield, O.
Weston Electrical Instrument Corp., 619 Frelinghuysen Ave., Newark, N. J.
Wheatland Tube Co., 606-608 Real Estate Trust Bldg., Philadelphia, Pa.
Wheeler Mfg. Co., C. H., 19th, Lehigh & Sedgley Aves., Philadelphia, Pa.
●Wheeling Steel Corp., Wheeling Steel Corp. Bldg., Wheeling, W. Va.
White Mfg. Co., 2362 University Ave., St. Paul, Minn.
Whitehead Metal Products Co. of New York, Inc., 304 Hudson St., New York, N. Y.
Whiting Corp., Harvey, Ill.
●Whitlock Coil Pipe Co., 100 South St., Hartford, Conn.
Whitney Mfg. Co., Bartholomew Ave., Hartford, Conn.
Whitney Mfg. Co., W. A., 636 Race St., Rockford, Ill.
●Whitney Metal Tool Co., 110 Forbes St., Rockford, Ill.
Wickes Boiler Co., 502 N. Water St., Saginaw, Mich.
●Wickwire Spencer Steel Co., 41 E. 42nd St., New York, N. Y.
Wiedemann Machine Co., 1815 Sedgley Ave., Philadelphia, Pa.
●Wiegand Co., Edwin L., 7610 Thomas Blvd., Pittsburgh, Pa.
Wilcolator Co, 17 Nevada St., Newark, N. J.
Willard Metallic Crypt Co., Willard, O.
Will-Burt Co., Orrville, O.
●Williams & Co., J. H., 75 Spring St., New York, N. Y.
Williams & Son, I. B., Dover, N. H.
Williams Gauge Co., 1620 Pennsylvania Ave., N. S., Pittsburgh, Pa.
Williams, Inc., F. C., 22805 Michigan Ave., Dearborn, Mich.
Williams Oil-O-Matic Heating Corp., 1201 East Bell, Bloomington, Ill.
Williams Valve Co., D. T., Spring Grove Ave. & Township Street, Cincinnati, O.
Will-Weld Mfg. Co., Inc., 1501 Jackson St., Omaha, Nebr.
Wilson & Co., 4100 S. Ashland Ave., Chicago, Ill.
Wilson Co., H. A., 97 Chestnut St., Newark, N. J.
●Wilson, Inc., Grant, 4115 W. Taylor St., Chicago, Ill.
Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York, N. Y.
Winchester Repeating Arms Co., 275 Winchester Ave., New Haven, Conn.
●Wing Mfg. Co., L. J., 14th St. & 7th Ave., New York, N. Y.
Wiss & Sons Co., J., 33 Littleton Ave., Newark, N. J.
Wittenmeier Machinery Co., 850-860 N. Spaulding Ave., Chicago, Ill.
Wolff & Munier, Inc., 222 E. 41st St., New York, N. Y.
Wolverine Tube Co., 1455 Central Ave., Detroit, Mich.
Wood Conversion Co., 1981 First National Bank Bldg., St. Paul, Minn.
Wood Industries, Inc., Gar, 7924 Riopelle St., Detroit, Mich.
Wood's Sons Co., T. B., 1275 Fifth Ave., Chambersburg, Pa.
Worthington-Gamon Meter Co., Harrison, N. J.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Wright-Austin Co., 315 W. Woodbridge St., Detroit, Mich.
Wyckoff & Son Co., A., 100 Home St., Elmira, N. Y.

X

X Laboratories, 25 W. 45th St., New York, N. Y.
X L Refrigerating Co., 1834 W. 59th St., Chicago, Ill.

Y

Yale & Towne Mfg. Co., Stamford, Conn.
Yardley Screen & Weather Strip Co., 142 Parsons Ave., Columbus, O.
●Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.
Yates-American Machine Co., Beloit, Wis.
Yeomans Bros. Co., 1433 N. Dayton St., Chicago, Ill.
●York Ice Machinery Corp., Roosevelt Ave., York, Pa.
York Oil Burner Co., Inc., P. R. R. & Jessup Pl., York, Pa.
Yost Mfg. Co., Meadville, Pa.
●Young Radiator Co., 709 Mead St., Racine, Wis.
Young Regulator Co., Dept. H, 4500 Euclid Ave., Cleveland, O.
Youngstown Pressed Steel Co., Warren, O.
Youngstown Sheet & Tube Co., 602 Stambaugh Bldg., Youngstown, O.

Z

Zapon-Brevolite Div., Atlas Powder Co., North Chicago, Ind.
Zeh & Hahnemann Co., 182-200 Vanderpool St., Newark, N. J.
Zobell Electric Motor Corp., 96 South Ave., Garwood, N. J.
Zonolite Corp. of Montana, Fisher Bldg., Detroit, Mich.

●Advertisement in this issue. See Index to Advertisers, page 232.

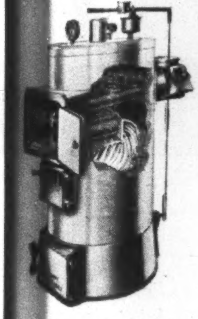
The Success of Automatic Heating and Winter Air Conditioning
—using OIL, GAS or STOKER and HAND-FIRING FUELS
—depends primarily on the boiler! . . . *So use*

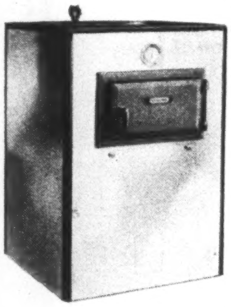
KEWANEE BOILERS

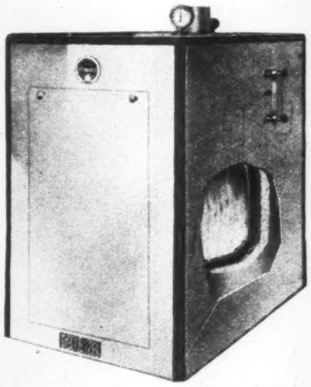
Round "R" Residence

SMARTLINE JACKETS
REG. U. S. PAT. OFF.

HEAT AND
YEAR 'ROUND
HOT WATER


ROUND JACKET


SMARTLINE REX


SMARTLINE
SQUARE REGAL

18
320 ft. to
2924 sq.ft.

2924
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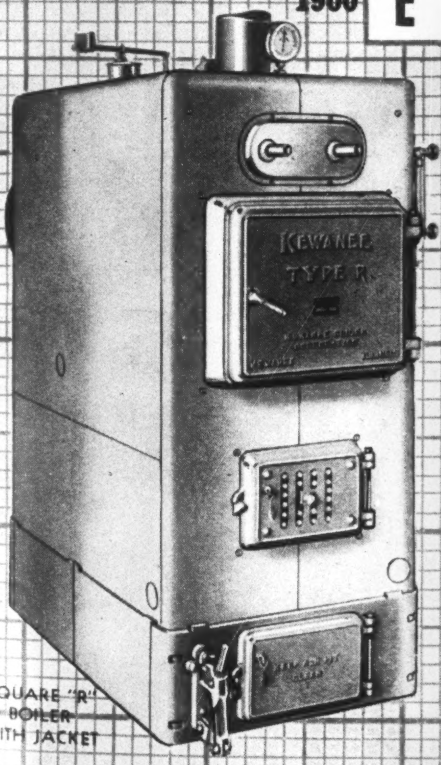
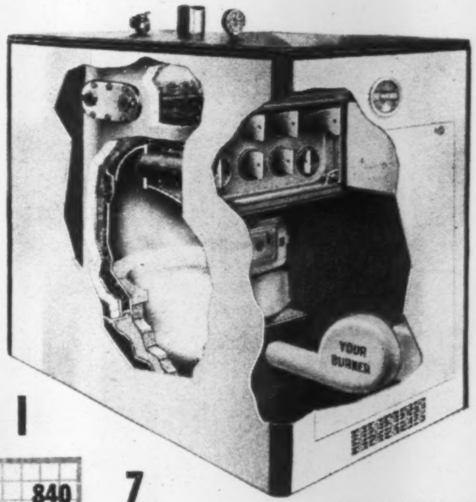


SQUARE "R" BOILER WITH JACKET



ROUND "R" REGAL
Complete Enclosures

NEW Small and Larger
Round "R" . . . also Square "R".

A size and style to
heat every home and building.

Batteries of the Biggest Boilers for Largest
Installations . . . Type "C" or Heavy Duty Riveted.

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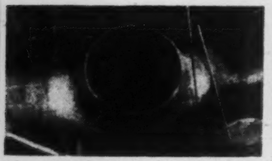
5th International Heating
& Ventilating Exposition,
Grand Central Palace, N.Y.

WELDOLETS · THREDOLETS
· · · Welded Outlets for Piping · · ·
NO CUTTING
NO THREADING
NO FITTING

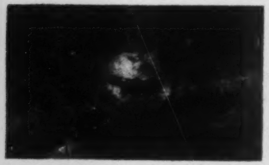
No Cutting - No Threading - No Fitting when WeldOlets and ThredOlets are used

WeldOlets and ThredOlets are easily installed. Simply select the position of the outlet, rub the fitting over the pipe several times to remove scale, mark center lines, and tack the WeldOlet or ThredOlet into position.

The WeldOlet or ThredOlet is then welded into place either by the electric-arc or oxy-acetylene method. A junction of full pipe strength and an outlet that is leak-proof is the result.



Where the outlet is 2" or larger, it is recommended that the button be removed after the welding operation. On small sizes, the fitting is used as a templet and the hole is cut in the main pipe first. A full inspection of the inside of the joint is possible by using these fittings, allowing removal of all scale, welding metal, etc.



The branch line is then welded into position using a simple Vee weld. In the event that a ThredOlet is used the branch pipe is threaded and screwed into place. The result is a junction of full pipe strength, absolutely leak-proof with turbulence and friction reduced to a minimum.

No Cutting—No Threading—No Fitting of the main pipe is necessary when WeldOlets and ThredOlets are used. Branch connections made with these fittings are strong, permanent and absolutely leak-proof. Preliminary layouts of the main pipe and branch are unnecessary. No templets are used.

Due to their funnel-shaped outlets, WeldOlets and ThredOlets provide free, unrestricted flow. Their heavy, external rib compensates for loss of strength in the main pipe when the hole is cut and distortion is entirely eliminated.

Available from stock with outlet sizes from 1/2" to 12" for all standard pipe sizes, they are equally well adapted to maintenance work and to new construction, whether indoors or out, above or below ground.

In addition to drop-forged steel in which they are stocked, WeldOlets and ThredOlets can be furnished in Wrought Iron, Toncan Iron, Brass, Monel, Everdur and other metals to meet every piping need.

The illustrations at the left show the ease with which they are installed. Try them at our expense. Sign the coupon below and attach to your company letterhead. It will bring you a sample and complete details.

The names "WeldOlets" and "ThredOlets" are Bonney trade-marks registered in the United States Patent Office. Full patent coverage has been granted in the United States and foreign countries.

BONNEY FORGE & TOOL WORKS
Forged Fittings Division
ALLENTOWN, PA.
Stocked by Leading Distributors

WELDOLETS THREDOLETS

Bulletin WT23 tells the complete story about WeldOlets and ThredOlets. The coupon will bring your copy and a sample trial fitting. Mail it today.

Please send me a sample WeldOlet or ThredOlet and a copy of Bulletin WT23 telling all about them.
HPAC-18

Name ....

St. & No. ....

City & State ....

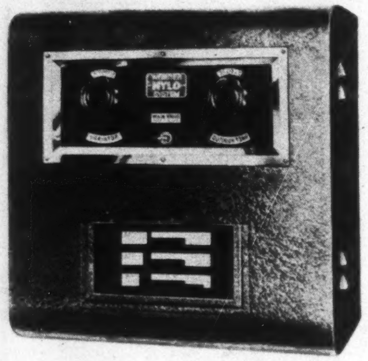
MAIL COUPON

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 228.

Heating Control Is Tuned Like Radio

No. 1375—With a control panel like a modern radio, including dials that illuminate when the switch is on, new "Hylo" control cabinet has been designed to give building operators "touch control" over heating. By setting a dial for the prevailing outdoor temperature once or twice a day, the right amount of heat is supplied to all radiators to keep every section of the building comfortably warm, says the manufacturer.



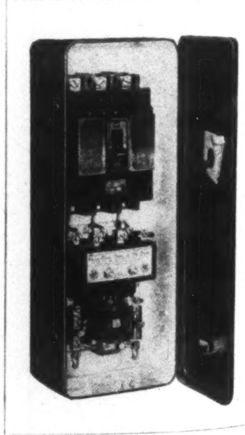
The control delivers steam continuously to all radiators and keeps them fractionally filled when less heat is desired. The "Variator" dial takes care of special conditions. Advanced, it provides for rapid heating up; retarded, it adjusts the steam supply for reduced night heating. An operating schedule specially worked out for each building is provided on the front of each cabinet. The control cabinet is attractively finished in crystalline lacquer and can be placed at any convenient operating point—next to a PBX telephone operator, for example.

This control is applicable to smaller office buildings, apartment houses, hospitals, deluxe residences and similar buildings where low pressure steam, either vapor or vacuum, is circulated through two pipe orificed systems. With modifications, it can be used to directly control stokers, or blowers and motor operated draft dampers on hand fired boilers.—Warren Webster & Co., 17th and Federal Sts., Camden, N. J.

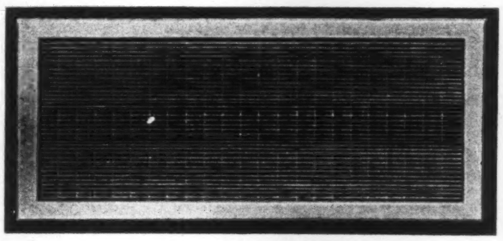
Offers Starting Switch With Circuit Breakers

No. 1376—A new combination starter utilizing circuit breakers has been recently developed. The conventional type combination starter consists of a hand operated disconnect switch and an automatic starter. In this new unit the standard disconnect switch has been replaced by circuit breakers. These units have a maximum rating of 30 hp, 220 volts; 50 hp, 440-550 volts.

The automatic starting switch is of the solenoid type, with double break, silver alloy contacts and two thermal overload relays. The circuit breaker is enclosed in a molded bakelite case and has three poles operated by a single lever. It can be tripped open or closed



AirMaster
GRILLES



Waterloo now provides F-l-e-x-i-b-l-e Selection of Grille Types

AirMaster grilles, dampers and frames are now completely interchangeable—providing almost limitless flexibility for all types of installations. This Flexible "Build-Up" Selection Method gives you an unique advantage in planning air conditioning installations, with grille units offering such features as:—"Camera-Shutter" Size Control—4-way Adjustable Direction Control—Graduated Volume Control—Streamline Grille Bars, etc.

New Catalog and Handbook gives complete details on the new "Build-Up" Selection Method. Get your Free copy and see our complete line at the International Heating and Ventilating Exposition, Booth 421, or write for your AirMaster Handbook today.

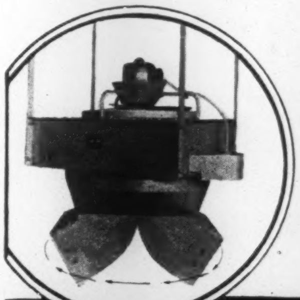
WATERLOO REGISTER CO.
Waterloo, Iowa **Seattle, Wash.**
In New York City—Air Conditioning Utilities, 8 W. 40th St.

WARMS EVERY SPOT IN THE PLANT

The All-Direction Floodlight Heater—

Is the last word in modern large area heating — a slowly revolving discharge projects uniformly and comfortably warmed air to EVERY part of the working area.

L. J. WING MFG. CO.
14th St. & 7th Avenue, New York, N. Y.



Wide, even diffusion of heat combined with far reaching projection.

Write for information.

WING *Featherweight*
REVOLVING DISCHARGE
UNIT HEATER

Addressed to Manufacturers of
AIR CONDITIONING EQUIPMENT
and
AIR CONDITIONING FURNACES

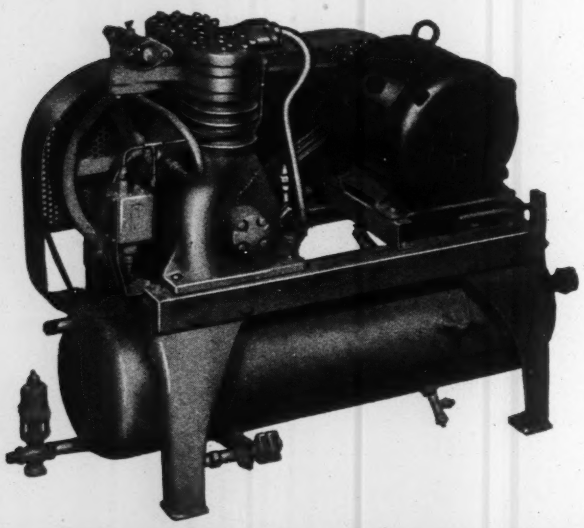
★ THE TREND IS TOWARD FACTORY ENGINEERED AND MATCHED UNITS THAT ENTER INTO THE SELECTION OF AN AIR CONDITIONING SYSTEM.

★ YOUR DEALER RIGHTLY LOOKS TO YOU FOR COMPLETE, BALANCED EQUIPMENT.

★ YOU CAN CONFIDENTLY LOOK TO US FOR REFRIGERATING UNITS THAT WILL UPHOLD THE REPUTATION OF YOUR PRODUCT.

The leading manufacturers of the industry are using Universal Cooler refrigerating machines. The Universal Cooler line consists of over 100 standard units in all sizes from 1/6 h.p. to 15 h.p. reflecting over 16 years' experience in this one field. In addition, special units may be readily designed from our complete line of compressors. We offer our services in assisting in the engineering, selection and arrangement of refrigerating units and coils to match your equipment. Our well equipped application engineering department has the facilities to give you the assistance you need. Write for complete details. UNIVERSAL COOLER CORPORATION, Commercial Sales Dept., Detroit, Michigan. In Canada: Universal Cooler Co. of Canada, Ltd., Brantford, Ont.

Listed under Reexamination Service of Underwriters' Laboratories, Inc.



UNIVERSAL COOLER

in the same manner as an ordinary disconnect switch. However, an overload in any pole trips a bimetal thermal unit and opens the breaker. All poles are also equipped with an instantaneous magnetic trip.

Reliable, accurate protection against sustained overloads is afforded by the resisto-therm relays on the automatic starter, the maker states. Short circuit protection is provided by the bimetal and magnetic trips on the circuit breaker.—Allen-Bradley Co., 1335 S. First St., Milwaukee, Wis.

Adds Silica Gel Dehumidifying Equipment

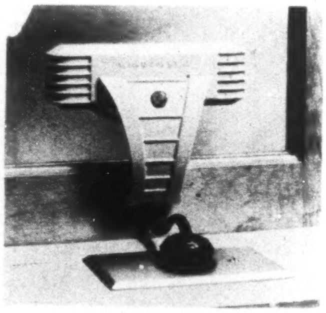
No. 1377—Carrier Corp. has just announced the addition of silica gel dehumidifying equipment. Essentially, the apparatus consists of a series of silica gel trays or beds, motor driven fans to convey the air to be dehydrated, a gas heater to produce reactivating air, and automatic controls for continuous operation, all self contained in a suitable housing.

The need for a means of direct dehumidifying (without the need of low temperature), as an economic alternate or adjunct to the more conventional refrigeration method, arises out of the fact that it is often important or even essential from a climatic, varying load, or industrial processing standpoint to control the moisture content in air independently of the temperature of the air, the announcement stated. This is particularly true for applications requiring lower than average humidities for process purposes as well as for general air conditioning. Such requirements are now economically met by this equipment.

This principle has been utilized in combination with mechanical and centrifugal refrigeration air conditioning systems. It is being used in this manner to condition one section of Carrier's new windowless office building.—Carrier Corp., Syracuse, N. Y.

Window Condensation Control Improved

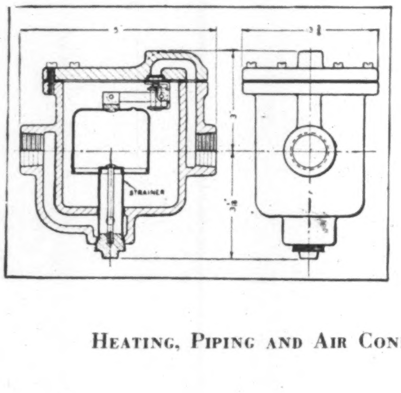
No. 1378—An addition to controls for air conditioning is an improved automatic window condensation control instrument just announced.



The problem of condensation on windows during winter humidification is eliminated by the installation of this "Windowstat," the maker says. Particular attention is drawn by the manufacturer to the handsome appearance presented by the new design which is mounted normally in accordance with the illustration. The unit is but 5⅜ in. wide by 1¾ in. deep by 4½ in. high (the latter including the mounting bracket).

The control operates fully automatically and prevents window condensation regardless of what may bring this about, either from an indoor or outdoor source, even though no outdoor connections are required.—Julien P. Friez & Sons, Inc., 4 N. Central Ave., Baltimore, Md.

Announces Straight Through Inverted Bucket Trap



No. 1379 — A new straightway type has been added to a line of inverted bucket steam traps. It is available in one size with ⅜ or ½ in. inlet and outlet connections.

These connections are arranged on opposite sides of the body on the

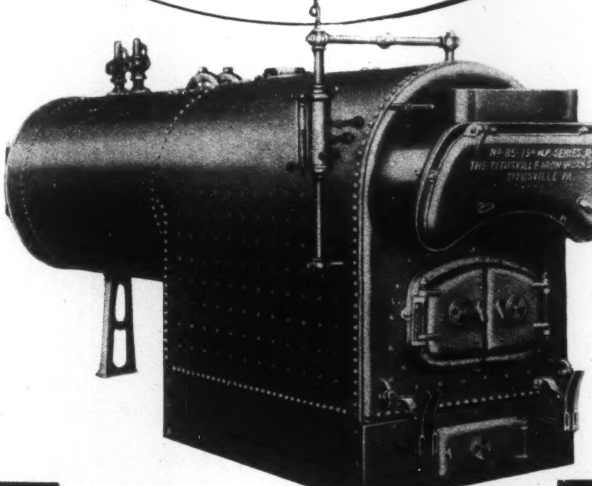
FOR DEPENDABLE POWER & HEAT

You can't beat the...

TITUSVILLE

Series "R-P"

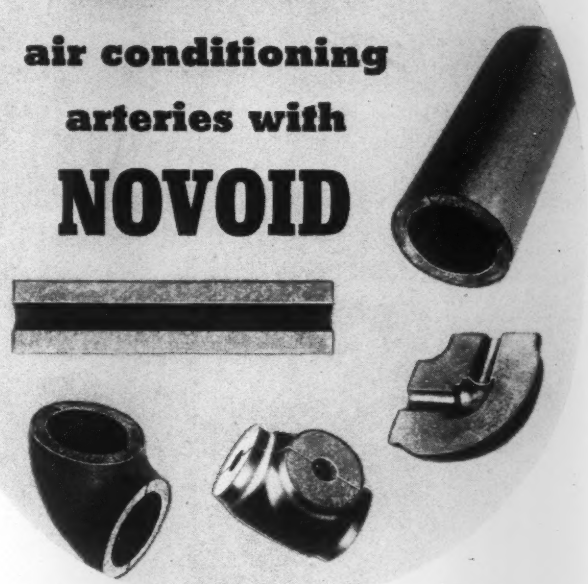
RIVETED HIGH PRESSURE BOILER



Designed in strict accordance with the latest ASME Code and thoroughly inspected during their entire construction by a representative of the Hartford Steam Boiler Inspection and Insurance Company, Titusville Portable Return Tubular Firebox Boilers Series "RP" are 100 per cent dependable. Available for 100 to 150 lbs. pressure in all standard sizes. Ask for Bulletin No. 9090.

The TITUSVILLE IRON WORKS CO.
Division of Struthers-Wells Titusville Corporation
TITUSVILLE, PA.

GUARD
air conditioning arteries with
NOVOID



COLD LINES are the arteries of an air conditioning system. Protect these arteries — guard the temperature they carry—with insulation of Novoid Cork Covering.

Properly installed on circulating lines, Novoid Cork Covering and Fitting Covers help maintain uniform temperatures. Because heat does not penetrate cork's unique cell structure, Novoid helps air conditioning systems to operate more efficiently and more economically.

Novoid Cork Covering and Fitting Covers are available in a complete range of standard pipe sizes. For special fittings, Novoid Fitting Covers can be fabricated to order, saving erection time and the cost of making assembled fitting covers at the job. Novoid Welding Ell Covers (90° and 45°), are made to fit all types of metal welding ells—long or standard radius. Light weight, ice water thickness is adequate for temperatures above 35° F., and reduces weight on the line and hangers. For full information, mail the coupon or write Cork Import Corporation, 330 West 42nd Street, New York City.

SEE OUR EXHIBIT, BOOTH 337, AT THE 5TH INTERNATIONAL HEATING & VENTILATING EXPOSITION, GRAND CENTRAL PALACE, NEW YORK, JANUARY 24-28, 1938

NOVOID CORK PIPE COVERING

MAIL COUPON FOR FULL DETAILS

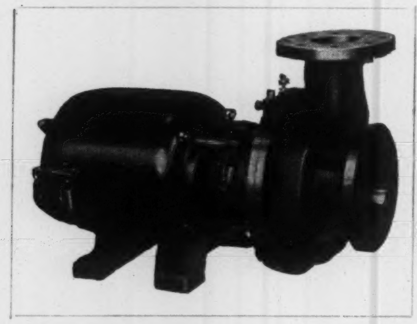
Cork Import Corporation
330 W. 42nd Street, New York City
Please send me complete information about Novoid Cork Covering for air conditioning pipe lines.
Name ....
Street ....
City and State ....

same center line to provide a straight through connection, which, according to the maker, has the advantage of simplifying the pipe connections in a number of installations, particularly in connection with small equipment.

As in the maker's other inverted bucket traps, this new type has all the working mechanism attached to the trap cover so that it can be removed by lifting off the cover without disturbing the pipe connections. A strainer is built into the trap and no separate strainer is necessary.—Sarco Co., Inc., 183 Madison Ave., New York, N. Y.

Offers Motor Mounted Pumping Units

No. 1380—Simplicity of design, compact construction, high efficiency and moderate cost are among the advantages of a new line of motor mounted pumps made for a wide scope of industrial requirements, says the manufacturer. Sixty-three units, comprising a range of capacities from 5 to 650 gpm are offered and are available with three phase motors. Single phase motors are furnished for 52 units of the line.

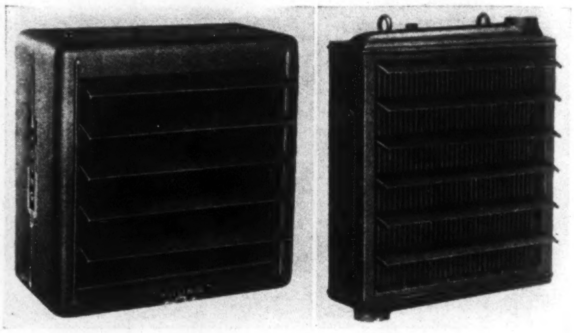


The impeller is the semi - enclosed, three vane type with non-overload power feature. It is adjustable for capacity, head, clearance and wear. The one piece, over size shaft is protected against abrasion. Integral construction of the impeller and shaft protecting sleeve prevents liquid from contacting the motor pump shaft.

A two piece, split type, bronze gland permits access to the stuffing box, which has a water and grease seal on some units and an adjustable water seal (which can be readily changed to grease or fresh water seal) on the others. Motors are the drip-proof type with moisture repellent insulation, deep groove ball bearings, and fan ventilation.—Deming Co., 14 Aetna St., Salem, Ohio.

Unit Heater Improvements Shown

No. 1381—Illustrations show changes made in outward appearance of new line of unit heaters in contrast to the older model. The steel casing is made in one piece, of welded construction, minimizing vibration and eliminating rattles. The units are finished in an oven baked, deep brown crackle, trimmed in chrome.



Changes have also been made in the design of the heating element. The core depth has been increased one-third and a more liberal fin spacing gives a larger volume of air at a lower temperature. Fins and tubes are pure lake copper. The supply and return header tanks are made cast in one piece. Tubes are rolled in the headers and secured by ferrules.

A NEW INSTRUMENT OF EXCEPTIONAL MERIT

THE T. T. SMOKE GUN

Uses the same chemical that the United States Navy employs when laying down a smoke screen, or the air pilot who writes cigarette advertisements in gigantic letters of white against the blue background of the sky.

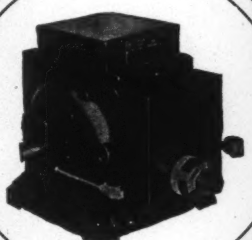
Simple . . . Inexpensive . . . Harmless . . . Valuable in tracing air currents, determining the direction and velocity of air flow, and the general behavior of either warm or cold air in conditioned rooms, etc. Useful and time saving in balancing installations.

PRICE, in suitable carrying case with 3 refill capsules and complete instructions $12.50
(One reloading capsule will produce 1,000 puffs of dense white smoke.)

E. VERNON HILL
179 W. Washington St.—Chicago

Holtzer Cabot MOTORS

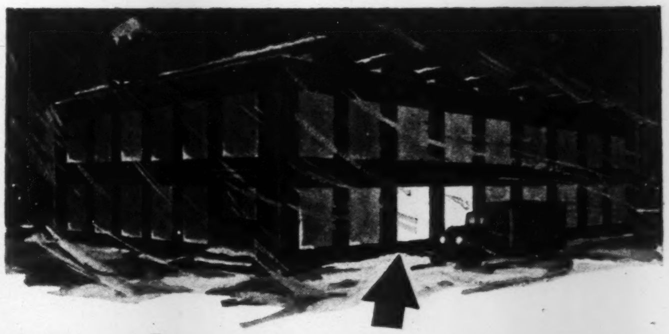
are built Quiet
and
stay Quiet



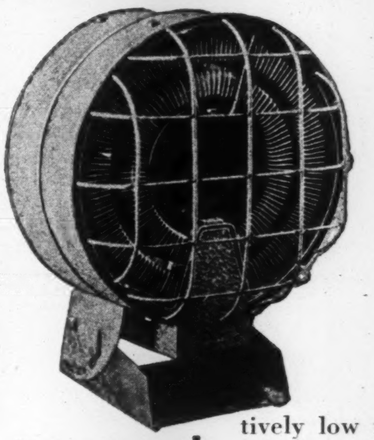
WILL·GIVE·LONG
QUIET·SERVICE
·· FREE·FROM·TROUBLE

Let us help solve
your Motor Problem

THE HOLTZER-CABOT
ELECTRIC COMPANY
Boston, Mass.
MOTOR SPECIALISTS.



Here's where you save *with* CHROMALOX ELECTRIC UNIT HEATERS



Designed expressly for plant heating, the new Type UB Chromalox unit heater is built in capacities from 2 Kw. to 20 Kw. Note the adjustable supporting bracket, permitting attachment to either a horizontal or vertical surface, and allowing easy adjustment of the air stream in a wide vertical angle.

●

Process, heating, too, finds Chromalox electric heaters in types exactly suited to its needs. The entire subject of electric heat for all industrial purposes is covered in the 64-page Chromalox Book of Electric Heat, which many executives and engineers use for reference. Use the coupon for your copy.

Overtime heat is always a problem. Only a few men working late to get out a rush order, will mean boiler plant operation as well—unless a Chromalox electric unit heater or two takes on the overtime heating load in the department affected.

It doesn't take many instances like this to justify the comparatively low first cost and economical operation of Chromalox electric heat. On the score of convenience alone, many plant managers find these auxiliary heaters invaluable, not only in manufacturing departments but in the offices as well, where they permit Sunday, holiday and evening conferences and emergency work without the need for previous arrangement with the boiler room.

Once installed, these unit heaters demonstrate usefulness throughout almost the entire year. They provide comfort in the occasional snappy days of spring or fall. They help out the main heating system in sub-zero weather. They force the circulation of warm air. Best of all, they can be installed anywhere a wire can reach.

●

Chromalox unit heaters are built in all required sizes and types. Get the facts—mail the coupon NOW.

Mail With Your Business Letterhead

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. **Pittsburgh, Pa.**

Send me the CHROMALOX BOOK OF ELECTRIC HEAT.

Name .... **Position** ....

For all-round safety and dependability specify...

W-S FORGED STEEL FITTINGS

W-S SCREW END FITTINGS

For complete satisfactory service, on pipe lines carrying oil, gas, steam, ammonia or water under high pressures or temperatures, use W-S Forged Steel Fittings.

They are available in a complete range of sizes in screw end style or with socket end for welding.

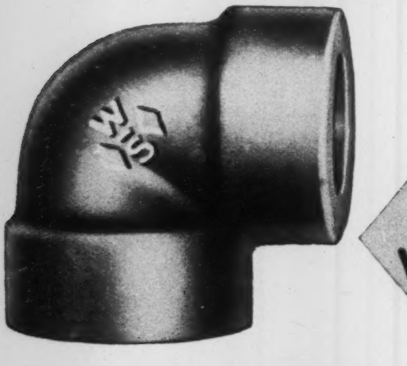
Both screw end and welding fittings are bored from solid drop forgings. They have heavy walls uniform in thickness which means extra strength and safety in service. Threads are accurately cut and perfectly aligned.

W-S Welding Fittings are provided with a counterbore which assures positive alignment before and after welding.

Use W-S Fittings on your next piping installation, let them prove their worth under actual operating conditions.

Ask for Bulletin A-3.

THE WATSON-STILLMAN COMPANY
140 Aldene Road
Roselle, New Jersey

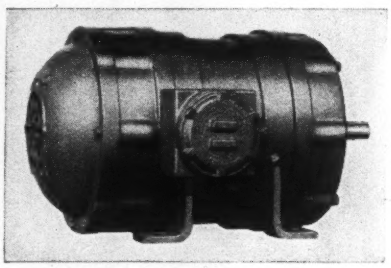


W-S SOCKET END WELDING FITTINGS

FOR HIGH PRESSURE AND HIGH TEMPERATURE, OIL, GAS, STEAM, HYDRAULIC AND AMMONIA SERVICE

The entire heating element, motor and fan is assembled separate and insulated from the casing, to overcome motor vibrations and stresses due to expansion and contraction of the coil. The line consists of 24 single units and four twin units, ranging in capacity from 18,000 to 658,000 Btu per hr.—Young Radiator Co., 709 Mead St., Racine, Wis.

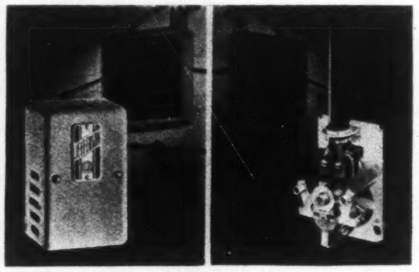
Explosion Proof Motors Announced



No. 1382—Recently announced line of explosion proof, squirrel cage, alternating current motors, with mounting dimensions conforming to N.E.M.A. standards have been tested and approved by the Underwriters' Laboratories for hazardous locations which include those in which flammable volatile liquids, highly flammable gases, mixtures or other highly flammable substances are made used or stored in other than the original containers, according to the manufacturer.

The construction is such that all working parts are completely enclosed, and the housing is strong enough to withstand even an internal explosion without bursting, loosening the joints, or permitting flame to escape into the outside air. Rotors are integrally cast to assure reliability and uniformity of performance.—Reliance Electric & Engrg. Co., Ivanhoe Rd., Cleveland, Ohio.

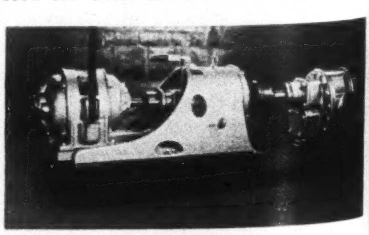
Temperature Controls Are Tamper Proof



No. 1383—There are cases where unauthorized or easy adjustment of thermostats is not desirable and for this reason a concealed adjustment type of air switch control is now offered. The control knob and scale plate are removed from the outside of the enclosing case, and range adjustment can be made only by removing the case, as shown in the accompanying view. The absence of the usual control knob removes the temptation of tampering.—Jefferson Electric Co., 25th and Madison Sts., Bellwood, Ill.

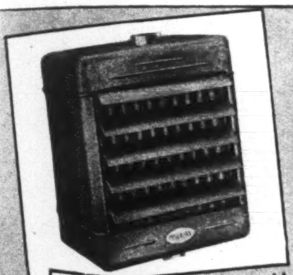
Liquids of Varying Viscosity Handled by Pumping Unit

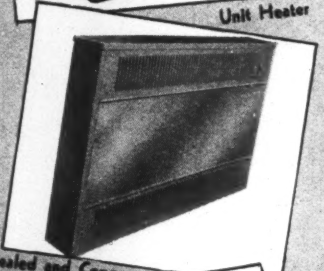
No. 1384—A unique compact pumping unit for bulk transfer service where both thin and highly viscous liquids are handled is of the herringbone gear impeller type driven by a constant speed motor or internal combustion engine through a two speed enclosed transmission. For light liquids, the pump may be operated at high speed, while for viscous liquids the speed of the pump may be reduced. In either case, the full power of the prime mover is employed.



In conventional applications of single pumping units on such service, motors are selected for the heaviest loads and are operated at a fraction of their rated power when pumping the thinner liquids, the maker points out. The new unit affords maximum efficiency because a relatively

McQUAY


Unit Heater


Concealed and Copper Radiation

Air Conditioning Unit (Floor Type)

Manufacturers of Equipment

For All Phases of

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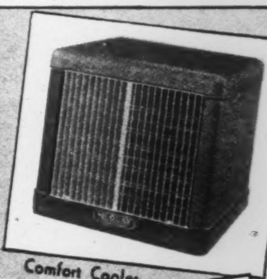
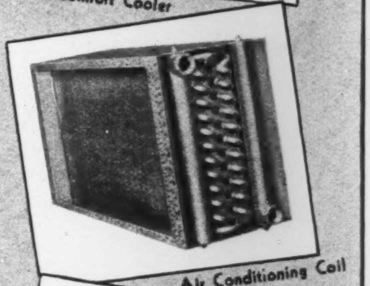
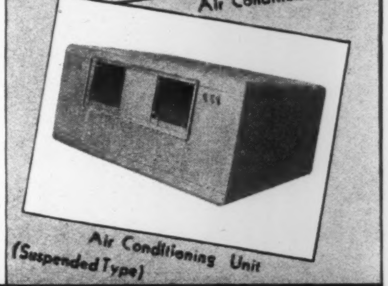

Comfort Cooler

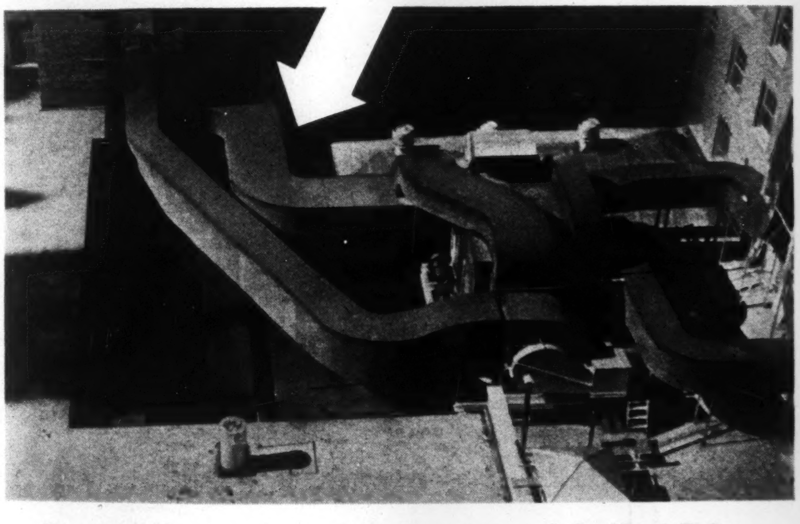

Air Conditioning Coil


Air Conditioning Unit (Suspended Type)

McQUAY, INC.

1600 BROADWAY NORTHEAST
MINNEAPOLIS, MINNESOTA

MUNDET CORK INSULATION *for*


Ducts in the new air conditioning system of the Hotel Baker, Dallas, Texas, are completely protected with "Jointite" Corkboard.

AIR CONDITIONING

Any infiltration of warm air imposes an extra load on the air conditioning plant. For this reason, ducts and pipe lines should be adequately protected with "Jointite" Cork insulation. "Jointite" products comprise corkboard in correct thicknesses for air conditioning, cork lagging for insulating cylindrical surfaces, moulded cork pipe covering for low temperature lines and cork isolation for machinery vibration. Our engineering department will gladly submit full specification data.

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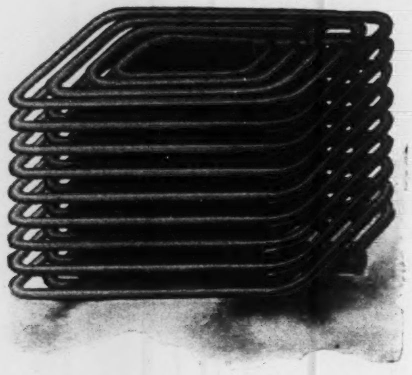
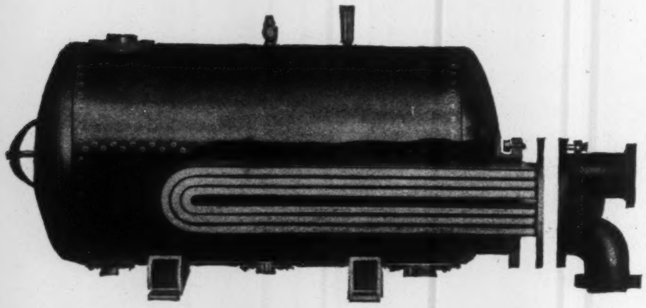


Made in any type from any known commercial metal.

When ordering coils for heating or cooling gases or liquids, please indicate: (1) the initial and final temperatures desired (2) quantity per hour to be heated or cooled (3) heating or cooling medium, kind, temperature and quantity (4) operation, intermittent or continuous. Kindly make your instructions as explicit and complete as possible.



Made in either vertical or horizontal design.

Instantaneous Heaters made in either U-Bend or Coil type.

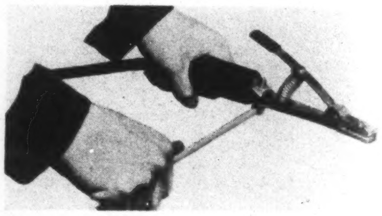
NATIONAL PIPE BENDING CO.
NEW HAVEN CONN.

small constant speed driver is used, it is stated.

Advantages include self priming, high suction qualities and positive displacement features. There are no valves to retard the liquid flow, and the entire unit requires little space.—Worthington Pump and Machinery Corp., Harrison, N. J.

Electrode Holder Weighs 14 Ounces

No. 1385—A new arc welding electrode holder features light weight for the capacity. It weighs only 14 oz and has a current capacity of 250 amperes continuous. The light weight, obtained without sacrifice of capacity, is attributed to use of formed steel parts, electrically welded.



Other features include simple type of connection to assure positive contact and eliminate loose connections, a cause of overheating.

Holder will accommodate any size electrode up to and including ¼ in.—Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

Repulsion Induction Motors Improved

No. 1386—Improved integral horsepower, repulsion induction, single phase motors have electrical characteristics that make them desirable for operating air compressors, viscous liquid pumps, refrigerant compressors, conveyors, etc., according to the maker. Their salient characteristics are high starting torque, low starting current, positive starting on low voltage, high power factor and efficiency.

Available in sizes 1 to 3 hp, in vertical and horizontal types.—Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo.

Starter for Motors Is Compact

No. 1387—A new, compact a-c across-the-line starter has just been released for sale. It is used on polyphase squirrel cage motors, and is suitable for innumerable applications, including fans, pumps, textile machinery, machine tools, etc.

This starter, measuring only 4¾ in. by 8 in. and known as N.E.M.A. size 0, is rated up to 2 hp, 550 volts. Among the features stressed by the manufacturer are pushbutton operation; positive quick make and break "twin-break" mechanism; silver-to-silver contacts; three and four pole construction; eutectic thermal overload protection, free tripping type; rubber mounted operating mechanism, removable without disturbing the conduit; and an aluminum interior finish to provide maximum visibility. The starter is interchangeable for all horsepower sizes within its rating by changing the thermal overload coils.

CUTLER-HAMMER

The modern "airstyled" enclosing case is small, yet allows ample space for wiring, which is further facilitated by a hook-on cover (removable by loosening one screw) which also permits group panel mounting with a minimum clearance between adjacent starters.

The skeleton type starter, consisting of the same mechanism, is for applications where it can be built into a machine cavity.—Cutler-Hammer, Inc., N. 12th St. and W. St. Paul Ave., Milwaukee, Wis.

Duplex Steam Pump Announced

No. 1388—A new duplex steam pump with eight cover, side pot type fluid end and improved piston valve steam end offers

ICE AND FROST
AIR CONDITIONING WITH FRICK REFRIGERATION
FRICK CO
FREON-12 COMPRESSORS
ICE-MAKING EQUIPMENT
LARGE AMMONIA COMPRESSORS
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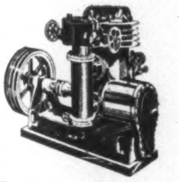

Frick Freon-12 compressors are designed for Air Conditioning Work.

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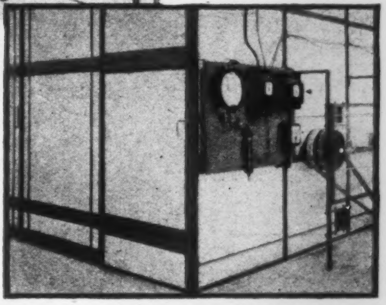
AMAZING "ARMORED" INSULATING BOARD

BUILDS COMPLETE FIRE-AND-MOISTURE-RESISTANT WALLS IN ONE UNIT!

Durable, fire-resistant surface of 1/8" asbestos-cement provides both interior and exterior finish.

Bonded with moisture-and-vapor-resistant adhesive to a core of Celotex Cane Fibre Board for permanent insulation.



Cemesto bolted to steel framing builds and insulates this dry kiln. Permits accurate control of temperature and humidity.

Cemesto—the asbestos-cement "armored" Celotex Insulating Board—builds and insulates finished walls in *one operation at one low cost.*

It's ideal for constructing industrial conditioning, drying and processing rooms, partitions and for other building uses where heat and high humidity resistance are essential. And it can be exposed to outside weather.

Sealed with a hard, durable asbestos-cement surface and vapor-resistant bond, the Celotex Cane Fibre core of Cemesto provides *permanently effective insulation,* proofed against termites, dry rot and fungus growth by the exclusive, patented Ferox Process.

Building with Cemesto is *quick and easy,* as it can be worked with carpenter's tools. Write us for further information, without obligation.

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for air or liquid temperature control. This accurate and dependable thermostat can be used for Bonnet Control in warm air heaters for Hot Water heaters. Furnished with suitable dials for various temperature ranges.

Hydraulic Thermostat

RELAYS

Type "M" Relay Mercury Tube Relay Type "C" Relay

"Diamond H" relays give long and dependable service for auxiliary control and to operate loads in heating and air conditioning equipment. Mercury Tube relays are silent with no exposed arc.

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Are extremely useful to operate many circuits from distant convenient points.

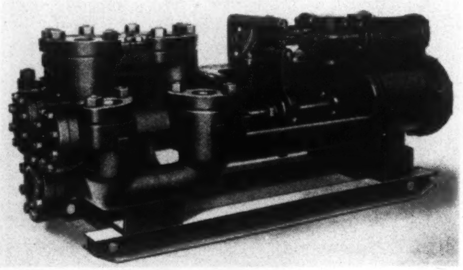
Send for Bulletin 10-K describing these Heat Control Devices

Remote Control Switch

PUT YOUR CONTROL PROBLEMS TO

THE HART MFG. CO., Hartford, Ct.

an economical means of handling oil, water or other free flowing liquids at high pressures and in large quantities, according to the maker. It was developed particularly for industrial and oil field boilerfeed service, but is well suited to many general industrial, railroad, and municipal applications. Sizes are available for capacities up to 148 gpm and fluid end pressures up to 1000 lb per sq in.



The balanced, piston type steam valves are designed to assure efficient operation even with high steam pressures and with superheated steam. Valve openings close completely, without loss of pressure, under all conditions of temperature and pressure, it is stated. The eight cover, side pot fluid end permits easy servicing. Each suction and discharge valve is located in its own valve pot and is accessible through the removal of a single valve pot cover. Large and direct fluid end passageways offer low resistance to flow.—Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill.

Damper Regulator Has Several Features

No. 1389—New "Valcalox" damper regulator has twelve points that are important to proper damper control, the maker says. These are: (1) locks securely; (2) friction shoe—no slipping of damper; (3) sleeve to receive bearing or bar; (4) positive action; (5) indicates position of damper at all times; (6) can be placed on all styles of dampers; (7) can be placed on partition wall or any location of duct; (8) rotates 360 degrees; (9) base is zinc alloy to eliminate corrosion of movable parts; (10) bearings permit easy installation of dampers in small ducts; (11) wrench bearings, screws, and nuts are cadmium plate; (12) placed on bearing with pressed fit—no vibration.—Young Regulator Co., Dept. H, 4500 Euclid Ave., Cleveland, Ohio.

Returns Condensation by Displacement

No. 1390—The "Direct Pressure Liquivator" is a unit for automatically returning condensation by means of the displacement principle. It consists of a stationary pressure tank to which an operating valve mechanism is externally connected. Counterweighted displacement tanks within the pressure tank provide the power for valve control through simple but effective leverage.

Since the valve mechanism is separate from the tank, it may be assembled with any sized tank for handling any given volume of liquid. Moreover, the remote control feature of the operating valves permits a variety of applications for special handling problems.

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BALDOR was first to develop a line of quiet, smooth-running motors with variable speed characteristics specifically designed for

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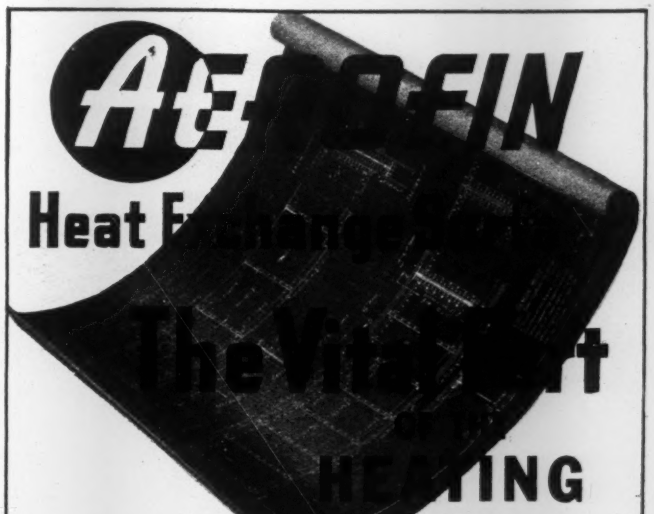

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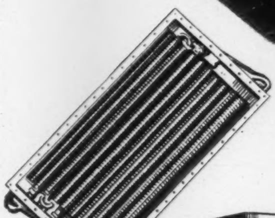
Heat Exchange Surface

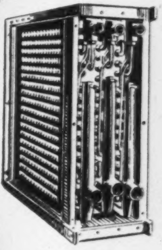
The Vital Part

of the

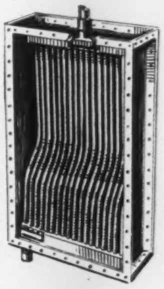
HEATING AND COOLING PLAN



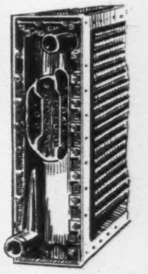
Universal Aerofin for Heating



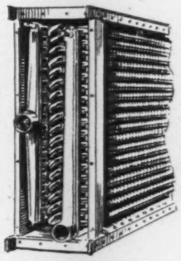
Aerofin Direct Expansion Unit Row Control



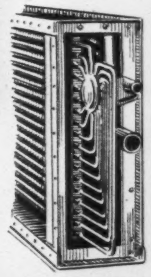
Flexitube Aerofin for Heating



Cleanable Tube Unit with Removable Header



Aerofin Continuous Tube Water Coil



Direct Expansion Unit with Centrifugal Header

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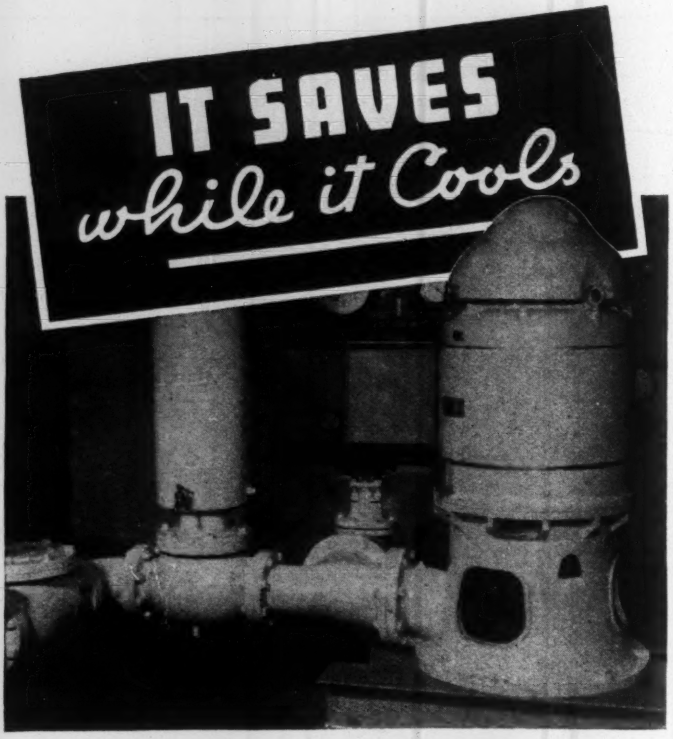

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for air cooling systems

Wherever well water is available and practical for use as a cooling agent, Deming Deep Well Turbine Pumps provide economy of installation and low operating and maintenance costs compared with other types of cooling equipment.

Among the many noteworthy features of Deming Turbine Pumps are *water lubrication* which continuously floods and efficiently lubricates all bearings; *adjustable impeller clearance* to make it easy to sustain original high performance for longer periods of time; *cutless rubber bearings* and *stainless steel bearing sleeves* which contribute to the successful performance and long life of Deming Turbines.

Write for FREE illustrated Catalog Bulletin which includes complete specifications, interior and exterior views, tables of sizes and capacities and many more *helpful* details about Deming Deep Well Turbine Pumps.

DEMING
Pumps
THE DEMING CO. • SALEM, OHIO

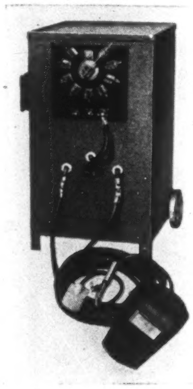
These units are available in both metering and non-metering types. Either can be furnished in a self-contained or a remote control assembly to meet individual requirements. The metering units are dependable within 2 per cent plus or minus, states the maker.—Morehead Mfg. Co., 4895 Grand River Ave., Detroit, Mich.

Pillow Block Offered With Grease Fitting

No. 1391—A ball bearing rubber pillow block is now offered with a grease fitting for out-of-the-ordinary conditions. This fitting permits frequent lubrication, if desirable, with the least amount of trouble, says the maker.

The molded rubber housing eliminates bearing noise and compensates for partial misalignment or longitudinal shaft expansion. The wide inner ring ball bearing with self-locking collar incorporated in the design provides an exceptional degree of shaft support as well as ease of installation and disassembly, it is said.—Fafnir Bearing Co., 37 Booth St., New Britain, Conn.

Welder for Industrial Plants

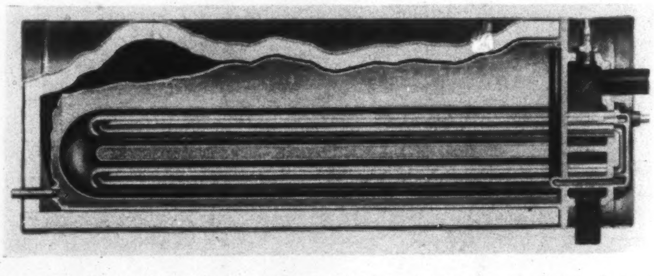


No. 1392—New portable a-c welder has been designed for heavy service in the average plant. Known as the "Industrial" model, it has a current range from 10 amperes to maximum output, with open circuit arc in three voltages, 80, 85, and 90, but higher voltage can be supplied if desired. The voltage changes are accomplished by changing the leads in the box mounted on the side of the cabinet.

The transformer coils are so constructed to permit maximum cooling with elimination of "hot spots" in the center of the coils, and it has forced air circulation to provide ample circulation of air, says the maker. The knife switch control is placed on the front of the cabinet. This welder has reactance control and static high frequency current and other features of construction as assurance that it will not overheat nor burn out under continuous service. It is made in four models, from 300 to 600 amperage, and weighs from 425 to 850 lb.—Giant Grip Mfg. Co., Oshkosh, Wis.

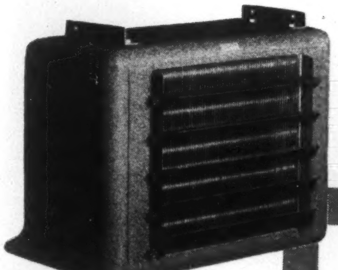
Water Heater Cuts Standby Losses

No. 1393—Recently announced "Thermo-voir" water heater is described by the maker as a tankless heater with a reservoir of hot water. In operation, city water fills the reservoir and is heated by boiler water flowing through tubes. When the "draw" occurs, the preheated water from the reservoir passes through two series of copper tubes before going to the fixtures. Thus the reservoir provides a reserve supply of hot water and the copper tubes act as instantaneous heaters if a long, steady draw depletes the water in the reservoir.

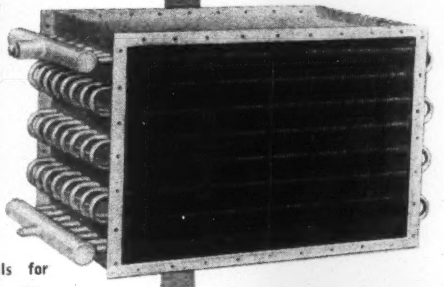


As, because of these features of design, there is no need for constantly maintaining high boiler water temperature, standby losses are reduced with this method, the maker says.—Bell & Gossett Co., 3000 Wallace St., Chicago, Ill.

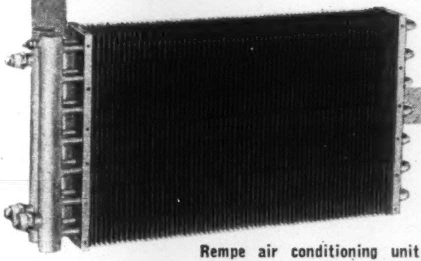
Ask REMPE



Comfort coolers as beautifully streamlined as they are efficient. For water or brine cooling, or for direct expansion refrigerants.



Air cooling coils for air conditioning systems headered for gas refrigerants.



Air cooling coils headered for water or brine systems. Similar type coils for steam and hot water heating.

WE do more than "sell coils." By far the most important part of our business is supplying our customers with the engineering data, advice and assistance to insure maximum efficiency and satisfaction with every Rempe product.

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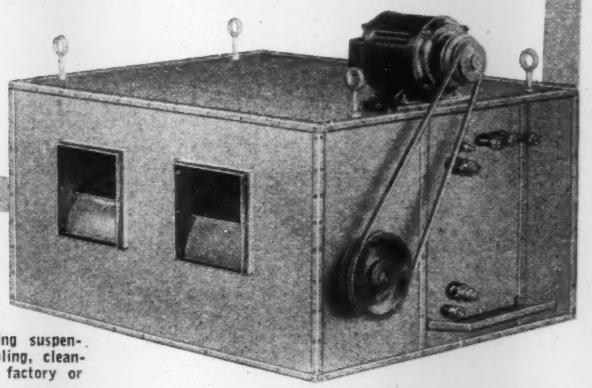

Rempe air conditioning unit for ceiling suspension or use on floor. For heating, cooling, cleaning and circulating air in the store, factory or office all year.

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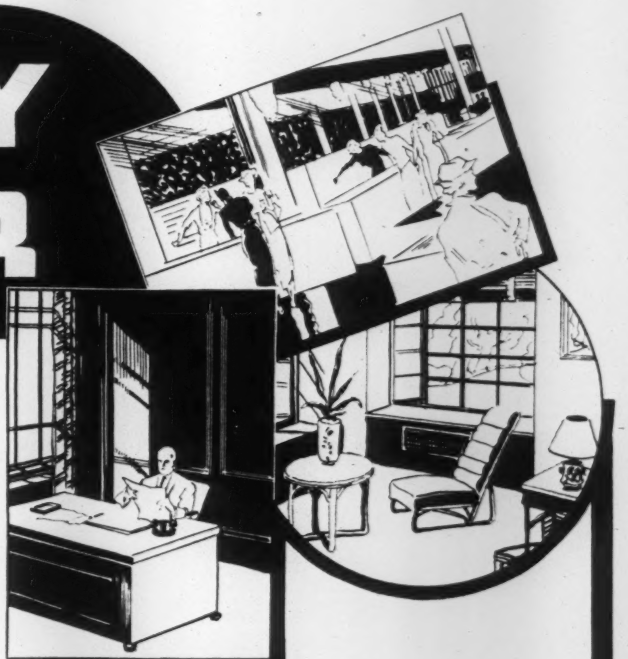

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The Hydro-Thermo Guard — a brand new, exclusive improvement in mechanical refrigeration —is an automatic, positive watchman that assures safe condensing temperature and maintains plant operation at all times, in spite of power line or mechanical failure.

This and other improved features enable the Wichita to offer you the most efficient and economical means for refrigerant condensing, regardless of water supply and sewage disposal system. Eliminates over 90% of condenser water costs. Investigate!

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HYDRON Metallic Bellows are used as control elements in temperature- and pressure-control devices, and for liquid or gas seals of compressors and pumps. We are specialists in the design and production of complete thermostatic and pressure units for temperature and pressure controls. We are, therefore, prepared to extend the fullest co-operation to engineering departments of control manufacturers in the solution of design and engineering problems.

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564 EAST FIRST STREET, BOSTON, MASS.
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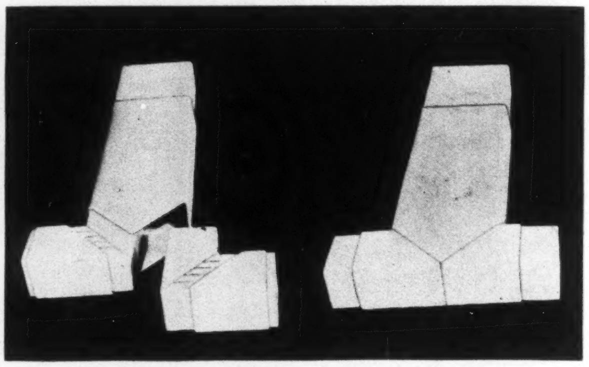
Producers of Bellows exclusively—serving automatic control manufacturers.

Prefabricated Duct Made of Asbestos

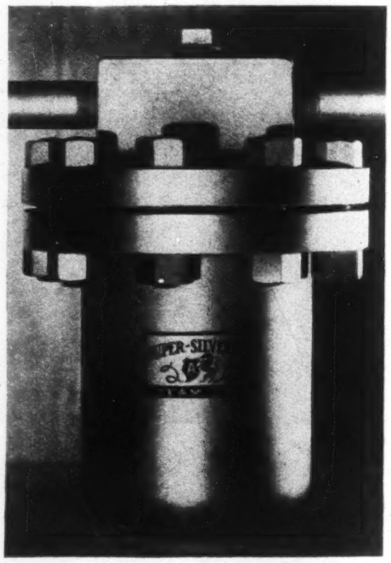
No. 1394—A prefabricated insulated air duct made entirely of asbestos ("Careyduct") has recently been announced for use in air conditioning and, according to the maker, has high strength and insulating value and thus insures an insulated installation at comparatively low cost.



The friction factor is said to be comparable to that of metal duct and the material used serves to reduce noises from the mechanical equipment.—Philip Carey Co., Wayne Ave., Lockland, Cincinnati, Ohio.

New Forged Steel Steam Traps Announced

No. 1395—A new forged steel steam trap, which incorporates all the features of the maker's regular "Super-Silvertop," averages 122 per cent greater in condensate capacity than its companion models, the manufacturer states. Its particular features are listed as economy, simplified piping and easy accessibility. The traps may be installed straight in line using the side inlet connection or as an elbow using the inlet connection at the top of the trap.



The case and head are made of forged steel and the gasket joints are of the recess type to prevent blow-outs. Head bolts are of heat treated alloy steel and the valve and seat are "Anderloy," a special chrome alloy for high resistance to erosion or wire drawing. All other parts, including the bucket, are of stainless steel.—V. D. Anderson Co., 1949 96th St., Cleveland, Ohio.

Gas Fired Boilers Improved

No. 1396—The advantages of a recently announced cabinet gas fired boiler are listed by the manufacturer as follows: (1) "Three-way" heat travel; (2) Unaffected by hard water conditions; (3) Large effective heating surfaces; (4) Completely insulated; (5) Large steam space; (6) Low upkeep costs; (7) Accessibility; (8) Modernly styled and finished; (9) Exclusively designed for gas, and (10) Fully automatic. By the "three-way" heat travel principle is meant the increasing of the efficiency of the heating surface in the boiler by extending the length of travel of

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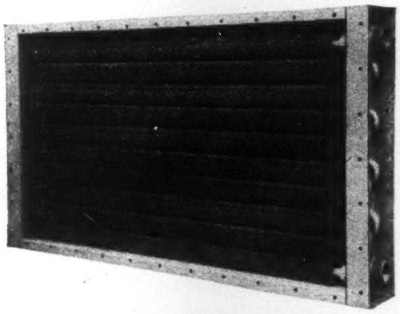

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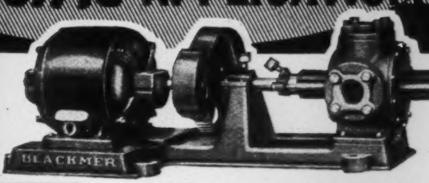

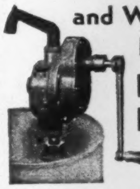

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BLACKMER offers as standard equipment such a wide range of types, sizes and various metal constructions, that even a high percentage of the so-called "special" applications can be handled successfully by standard BLACKMER Rotary Pumps.

Thus, whatever your problem—whatever the material to be pumped—it will pay you to get our recommendations. Often we save shrewd buyers the extra expense of made-to-order units.

Use our 30 years of experience to reduce your pumping costs — write us today! BLACKMER PUMP COMPANY, 1940 Century Ave., Grand Rapids, Mich. Branch Offices in All Principal Cities.

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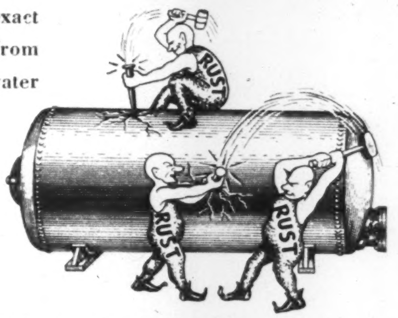
EXCLUSIVE BUCKET DESIGN—AUTOMATIC TAKE-UP FOR WEAR

Beware of these Enemies

Rust and red water exact large tolls every year from users of obsolete hot water heaters.



Rust cuts holes in ordinary heaters and sends them to the junk pile. It clogs pipes.

Patterson Everdur and Copper-Lined Hot Water Heaters are *guaranteed* not to rust or cause red water. Consequently, they are practically everlasting.

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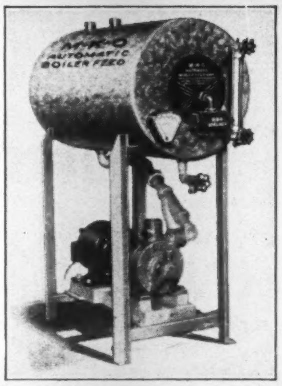

Automatically Maintains a Constant Water Level in High or Low Pressure Boilers . . . .

Wherever city water pressure is lower than desired steam pressure . . . wherever feed water must be pumped against high boiler pressure . . . condensate returned to boiler . . . and make-up water supplied . . . the M. K. O. Boiler Feed is needed. None other has all its features!

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CONTROLS ANY OIL THAT FLOWS!

This automatic lever-action valve has six times the opening and closing power of straight magnetic valves! Positive opening and tight closing assured on oils as heavy as No. 6 at room temperatures. Also controls water, air, gas or steam up to 125 lbs. pressure.

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- LEVER ACTION
- POWERFUL SOLENOID
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The modern, air-conditioning specialty that is ideal for installation in department stores, offices, restaurants, cocktail bars, barber shops, beauty parlors,—any place where individual or group ventilating, or air conditioning is desired.

The Punkah Louvre controls the direction and convection of air, and eliminates stratification. It adjusts at the touch of a finger to any desired position. It requires little space, and is quiet.

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90 STATE STREET **BOSTON, MASS.**

the hot flame gases before they reach the stack.

These boilers are available in eight sizes ranging from 1 to 15 boiler horsepower.—Kisco, Inc., 4414-18 W. Papin St., St. Louis, Mo.

Pliers Aid In Sweating Joints

No. 1397—For sweating joints on small copper tubing and fittings up to ⅜ in. diameter and for soldering small lugs and terminals in electrical work, a "midget" type of "Thermo-Grip" pliers has recently been announced. The power requirement of 300 watts permits use of the unit on standard lighting circuits.

The pliers are made of cast bronze with long, slender jaws so they will fit into restricted spaces. The jaws are hinged at the back and have a spring which holds them normally in open position.—Ideal Commutator Dresser Co., 1096 Park Ave., Sycamore, Ill.

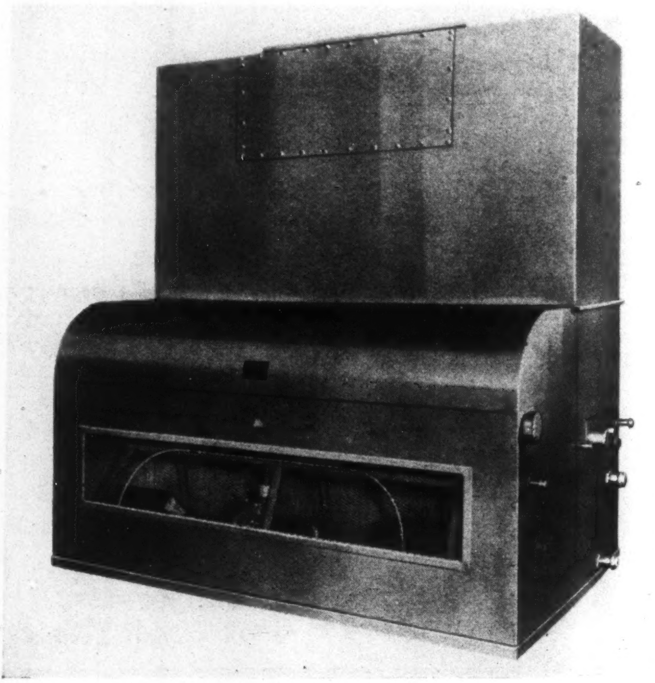
Evaporative Condenser Guards Against Shutdown

No. 1398—A new feature is incorporated in the "Wichita" evaporative condenser; it is the "hydro-thermo guard" which is a control that opens a valve and automatically connects the condenser with outside water service. This is to insure that the condenser will not be made inoperative any time, day or night, in case of power shutdown, fuse or any mechanical failure. The heat from the refrigerant in the case of such failure acts on the valve controlling the outside water supply to restore immediately the cooling spray over the coils.

This is particularly important, the manufacturer states, over Sundays, holidays or at nights when no engineer is available to take care of any unusual shutdown and where constant refrigeration for perishables in storage, for instance, is essential.

This evaporative condenser, which is offered for use with all makes of mechanical refrigeration for both commercial refrigeration and air conditioning service, is said to eliminate over 90 per cent of condenser water costs. In addition to the special guard described above, its other features include compact and protective designs, a coil composed entirely of prime surface tubing, a larger case than ordinary for the coil surface, and a special corrosion resistant, self-cleaning water diffuser in place of spray nozzles.

Nineteen models are available with capacities for air conditioning service ranging from 27,600 to 1,613,450 Btu per hr.—Motor Equipment Co., 214 W. Douglas, Wichita, Kansas.



THERE'S NOTHING TO WORRY ABOUT in GRID UNIT HEATERS-

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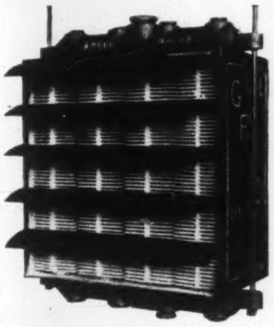

A different unit heater. The heating sections are cast aluminum alloy cast in one piece bonded to high test alloy iron steam chamber—a sturdy construction with fewest connections possible. That's why you should install GRID for real service, long life, economy in operation and dependability. Write for complete details and capacity tables.

THE UNIT HEATER & COOLER CO.
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A TRIUMPH OF TEAM WORK

What is back of Pomona's performance? Men — many men of widely diverse abilities — inventors, engineers, draughtsmen, layout men, metallurgists, chemists, foremen, brass, bronze and iron founders, machinists, grinders, polishers, enamelers, electricians, assemblers, inspectors, testers. Add cost accountants, bookkeepers, office help, traffic experts, shipping clerks—add salesmen and service men, available in the far reaches of the world — a triumph of intelligent cooperation, smoothed into effective daily service by thirty-five years of orderly experience.

Every buyer of a Pomona Pump buys man power and mind power in addition to the metal in the machine.

POMONA Oceans of Water PUMPS

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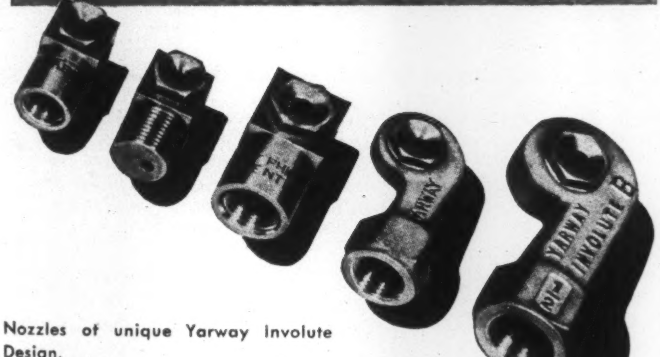
AIR CONDITIONING NOZZLES



Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

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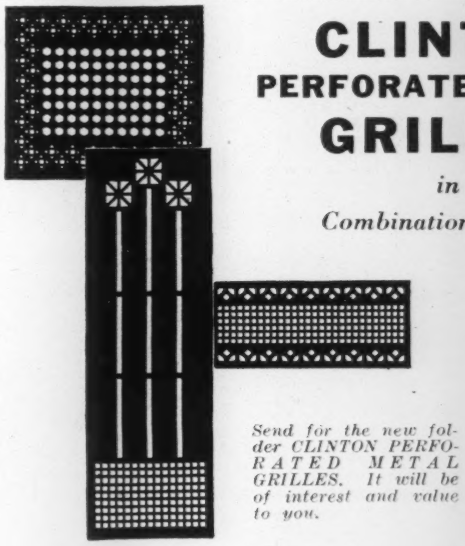

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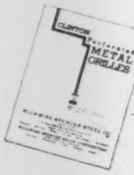

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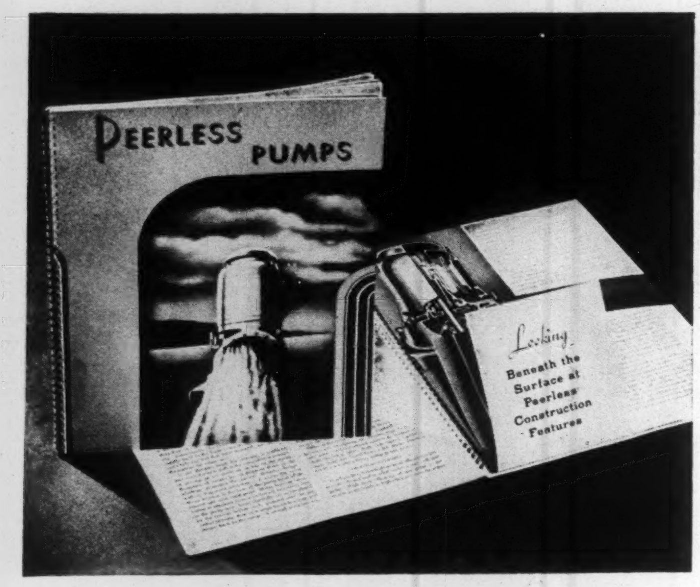
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RIDGID PIPE TOOLS

Conventions and Expositions

For complete and detailed information on the exposition and meetings to be held in New York City the week of January 24, see the "Show Section" on pages 29-44 of the editorial section in this issue. . . . The meeting programs, list of exhibitions, floor plans, etc., are given.

Fifth International Heating and Ventilating Exposition: January 24-28, 1938, Grand Central Palace, New York, N. Y. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

American Society of Heating and Ventilating Engineers: Annual meeting, January 24-28, Biltmore Hotel, New York, N. Y. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

National Warm Air Heating and Air Conditioning Association: Winter convention, January 25-26, Roosevelt Hotel, New York, N. Y. Managing Director, Allen W. Williams, 50 W. Broad St., Columbus, Ohio.

American Society of Refrigerating Engineers: Annual meeting, January 25-27, Roosevelt Hotel, New York, N. Y. Secretary, David L. Fiske, 37 W. 39th St., New York, N. Y.

Western Metal Exposition and Congress: March 21-25, Pan-Pacific Auditorium, Los Angeles, Calif. Auspices American Society for Metals, W. H. Eisenman, Secretary, 7016 Euclid Ave., Cleveland, Ohio.

Heating, Piping and Air Conditioning Contractors National Association: 1938 convention, May 31-June 2, Boston, Mass. Chairman of Convention Committee, Frank E. Kise. Headquarters Office, 1250 Sixth Ave., New York, N. Y.

American Public Health Association: Annual meeting, October 25-28, Kansas City, Mo. Headquarters Office, 50 W. 50th St., New York, N. Y.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 228. If you write direct to the manufacturer, be sure to describe carefully what literature you want, as the reference numbers given are for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 2626. BOILER FEED CONTROL: Northern Equipment Co., 1945 Grove Drive, Erie, Pa. 8 p. bulletin on "Copes Flowmatic" regulator for feeding boiler automatically according to steam flow. The regulator and its characteristics are described, typical boiler water level characteristic curves are presented, operation is explained, and specifications are given.

No. 2627. CENTRIFUGAL PUMPS: Dayton-Dowd Co., 115-17 York St., Quincy, Ill. 16 p. bulletin on close coupled centrifugal pumps for air washers, hot and cold water, brine, oils and gasoline, acids and chemicals, and general industrial service. Features of design and details of construction are presented, dimension drawings and dimension tables and rating tables are given. Four pages of useful pump data and instructions for figuring pumping problems conclude the booklet.

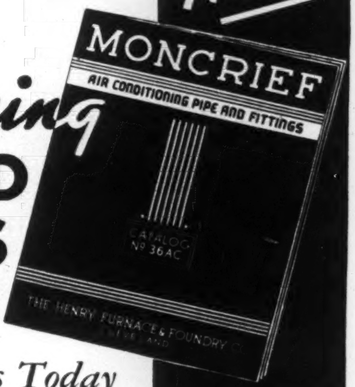
No. 2628. COMPRESSORS AND CONDENSING UNITS: Frick Co., W. Main St., Waynesboro, Pa. Data sheets giving specifications for three low pressure units for air conditioning

MONCRIEF

Air Conditioning

PIPE AND FITTINGS CATALOG

NEW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Leakage is impossible with Patterson Freon Coolers because the U-tube construction provides for expansion and contraction of each individual tube independently of all others. The entire tube bundle can be removed easily for inspection and cleaning.

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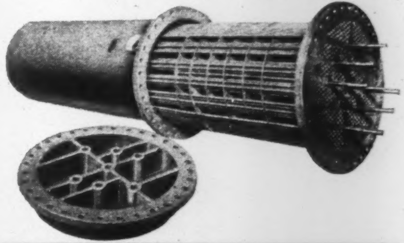

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Don't burn money every day during the season between winter and summer. This modern unit heater gives quantities of clean, odorless warmth — and directs it just where you want it. Write for information.

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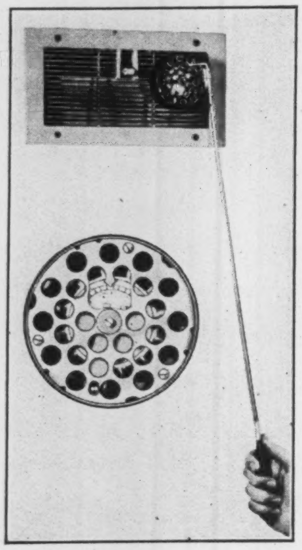

The "GRILLOMETER" is *NOT* an anemometer. No more watch timing and long division required. Climbing up on chairs and getting down on hands and knees have been eliminated. The Grillometer is the "*Yardstick of the Air.*" Place it before any fan unit, release the brake a moment by pressing the handle, then ease up and remove to read the air velocity at once. More accurate readings taken and completed in one-tenth the time! Range 50 to 3,000 F.P.M.

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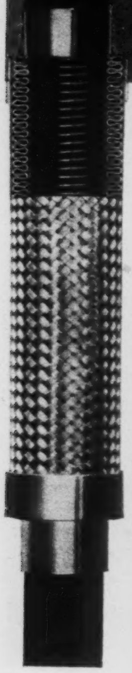
Stop
VIBRATION NOISE
in Compressor Lines



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which comprise complete assembly, including base, motor, compressor with valves, condenser, receiver, V-belt drive, water regulator and automatic starter; also data sheet on low pressure compressors for "Freon-12" or methyl chloride.

No. 2629. CONTROLLING VALVES: Automatic Switch Co., 154 Grand St., New York, N. Y. Miniature booklet on controlling valves electrically, treating the problem of what can be controlled, use of pilot control, choosing the proper valve, and the advantages of "Asco" solenoid valves. Also a circular describing these valves in more detail.

No. 2630. CONTROLS: National Regulator Div., Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn. 6 p. folder entitled "Why National?" discussing the advantages of these pneumatic controls for heating, ventilating and air conditioning. The "Helmet Seal" construction and other features are briefly described.

No. 2631. FLOW METERS: Foxboro Co., 106 Neponset Ave., Foxboro, Mass. 4 p. bulletin on flow meters for 1500 lb pressure, describing these special flow meters for high pressure measurement and illustrating design and construction.

No. 2632. HEATERS, COILS AND BENDS: National Pipe Bending Co., 122 River St., New Haven, Conn. 12 p. booklet illustrating and describing this company's feed water heaters, storage heaters, instantaneous heaters, fuel oil preheaters, coils and bends of pipe and tubing, and seamless spun kettles, pails and dippers of brass. Specifications and tables of technical data are included for the various heaters, and their uses are explained.

No. 2633. HEATING AND VENTILATING EQUIPMENT: Economy Electric Mfg. Co., 4634 W. 21st Pl., Chicago, Ill. 8 p. bulletin on bucket, disc, paddle and propeller exhaust fans, penthouses and shutters, and gravity ventilator power fans; 4 p. bulletin on blowers and inlet and outlet volume controls; 4 p. bulletin on propeller fan unit heaters, blower type unit heaters, blast coils and floor stand recirculating ducts.

No. 2634. HOSE: Chicago Metal Hose Corp., Maywood, Ill. 4 p. bulletin describing construction of "Rex-Weld" and "Rex-Tube" insulated steam hose; 4 p. bulletin describing "Rex-Tube" metal oil hose which conforms to U. S. Navy specifications.

No. 2635. INDUSTRIAL THERMOMETERS: C. J. Tagliabue Mfg. Co., 540 Park Ave., Brooklyn, N. Y. 24 p. industrial thermometer catalog giving conveniently arranged listings of complete line of "Tag" instruments. Miscellaneous thermometers are also described, including metal and wood back thermometers, hygrometers, U gages, vacuum gages and barometers.

No 2636. INSULATION: Dry-Zero Corp., Merchandise Mart, Chicago, Ill. 41 p. booklet particularly on the fundamentals of good refrigerator insulation, but also of interest because the use of air conditioning has created insulation problems in buildings similar to those encountered in the refrigeration field. The manner in which insulating materials retard passage of heat, the influence of moisture on refrigeration, and Bureau of Standards test results are described.

No. 2637. LUBRICATION: Fiske Brothers Refining Co., 129 Lockwood St., Newark, N. J. 4 p. circular on the control of friction, with particular reference to "Lubriplate" lubricants.

No. 2638. LUBRICATION: E. F. Houghton & Co., 240 W. Somerset St., Philadelphia, Pa. 16 p. booklet on "Sta-Put" lubricants describing their advantages and discussing the uses of the various kinds. Properties of lubricants are treated briefly.

No. 2639. MOTORS: Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill. 4 p. bulletin on vertical hollow and solid shaft polyphase, ball bearing, squirrel cage, induction motors, describing and illustrating features of construction in detail. These motors were developed primarily for direct connection to vertical shaft turbine, propeller and centrifugal type pumps.

No. 2640. MOTORS: General Electric Co., 1 River Rd., Schenectady, N. Y. 4 p. bulletin on vertical hollow shaft in-

12 Advantages of a Wheel Cutoff!

Beaver Model-A Portable Pipe Machine may be had with either a knife-type or wheel-type cutoff. However, the wheel cutoff has twelve definite advantages worthy of serious consideration.

1. Cuts full range ⅛ to 2-inch.
2. Cuts solid round bars and bolts up to 1-inch.
3. It's faster! Cuts 2-inch in 7 seconds.
4. It's simpler!
5. No "chatter."
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7. New wheels cost but 27c.
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9. Easier cutting.
10. Cuts shorter lengths.
11. Ball-bearing.
12. Cuts all kinds of pipe.

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BEAVER PIPE TOOLS

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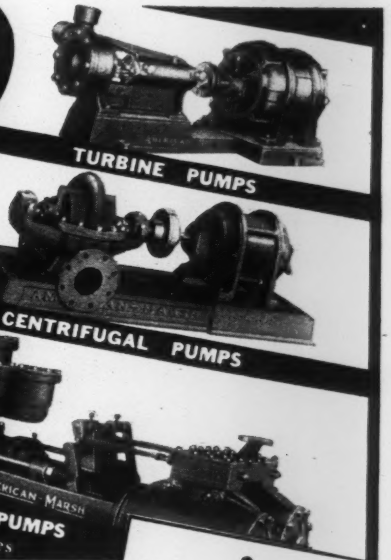

Somewhere in this broad line of modern, highly-efficient Turbine, Centrifugal and Reciprocating Pumps is exactly the equipment you need, no matter what your pumping problem. American-Marsh engineers can help you get results with UTMOST economy. We have done it a thousand times before! Write us for bulletins.

To better associate our Company name with our long established trade name—American-Marsh—we recently adopted the new Company name used in the signature below.

However, there has been NO CHANGE in financial structure, management, or quality standards maintained for over 60 years.

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Styled to the tempo of the moment under the expert supervision of W & J Sloane, Biltmore rooms and suites are generous in size and are your assurance of the utmost in airy comfort.

Directly connected with Grand Central, The Biltmore offers you a time-saving New York home, convenient to the important amusement centers, the smart shops of Fifth and Madison Avenues, and the vital New York you wish to see. Single rooms from $6; double rooms from $8; suites from $12.

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Dart unions have extra wide, bronze seats, ground to a full-bearing true ball joint that's tight, time and again, without jamming. Darts have extra heavy, air-refined, malleable-iron bodies and nuts, that resist pipe strains, thread distortion, wrench abuse, repeated use.

That's why Darts cost you less in service. Write for one to try at our expense. What size do you use most?

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● For 25 years we have specialized in the manufacture of high-grade metal working tools . . . punches, shears, benders, bending brakes, and many other useful items. Our new Catalog No. 11 contains over 80 different tools that should be in every shop. Send for your copy today. See our nation-wide dealers.

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● Cuts an accurate, clean 60° VEE-notch in one operation. Capacity 13/16" deep notch in 20 ga. metal. Weight 1 lb. Also investigate our new No. 41B Dovetail Notcher.

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Unit Heaters (Propellor & Blower type)
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Heating and Cooling Coils
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Air Conditioning Stench!

ANNIS Air Filters and ANNIS Odorpak Filters remove air conditioning stench. A greater volume of recirculated air can be used.

ANNIS ENGINEERING

Write for our new data sheets.

ANNIS AIR FILTERS, 1515 Gardena Ave., Glendale, Calif.
Pioneers in air filter manufacture. *Established 1923*

Heating, Piping and Air Conditioning,
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1-38

Please ask the manufacturer to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

1375 1376 1377 1378 1379 1380 1381
1382 1383 1384 1385 1386 1387 1388
1389 1390 1391 1392 1393 1394 [illegible]
1396 1397 1398
2626 2627 2628 2629 2630 2631 2632
2633 2634 2635 2636 2637 2638 2639
2640 2641 2642 2643 2644 2645 2646
2647 2648

Name .... Title ....

Company ....

Address ....

City .... State ....

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duction motors designed to meet the requirements of modern deep well turbine pumps, describing and illustrating features in detail.

No. 2641. PUMPS: F. E. Myers & Bro. Co., Ashland, Ohio. 301 p. 1938 pump catalog covering many different types and accessory equipment.

No. 2642. PUMPS: Pomona Pump Co., 206 E. Commercial St., Pomona, Cal. 8 p. bulletin on "Pomona-Niagara" pumps for low lift river or ditch installation for low head, general service, describing features and illustrating various applications.

No. 2643. RECORDING THERMOMETERS: Foxboro Co., 106 Neponset Ave., Foxboro, Mass. 40 p. catalog of recording thermometers for industrial use, claimed to be free of technicalities and interesting in arrangement. A brief story on the value of thermometers is followed by separate descriptions of this company's instruments. The thermometers are available in two sizes, two types, four classes, with more than 50 standard bulbs, nine types of connection tubing, and with some 660 different charts.

No. 2644. RESISTANCE THERMOMETERS: Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., 4534 Wayne Ave., Philadelphia, Pa. Folder describing a new resistance thermometer and its use in furnishing a positive means of checking the correct temperature throughout an entire building from one central point in order to reduce heating cost and keep occupants satisfied.

No. 2645. STEAM JET EJECTORS: Worthington Pump and Machinery Corp., Harrison, N. J. Bulletin covering improved single stage steam jet ejectors, with information on applications, materials and dimensions.

No. 2646. UNIT HEATERS: American Blower Corp., 6000 Russell St., Detroit, Mich. 60 p. technical bulletin on "Sirocco" unit heaters, featuring modern design and appearance, illustrating and describing construction, and giving capacity tables for V-belt driven units and direct connected units, external resistance tables, data on forced circulation hot water systems, and showing installation arrangements, control and piping diagrams. Various other pertinent information is presented, including sound ratings for these heaters.

No. 2647. WATER VAPOR REFRIGERATION: Ingersoll-Rand, Phillipsburg, N. J. 32 p. booklet on centrifugal water vapor refrigeration units, driven either by electric motor or steam turbine, with descriptions of the machines and their applications as well as their characteristics, including power and condensing water requirements, self regulation, reserve capacity, etc. A number of installations are pictured.

No. 2648. WROUGHT IRON: A. M. Byers Co., Clark Bldg., Pittsburgh, Pa. 32 p. booklet entitled "101 Uses for Wrought Iron" showing by means of numerous pictures and informative captions the many applications of this material in industry and commercial buildings.

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Piping THAT IS FUNDAMENTALLY Right

FOR AIR CONDITIONING· PLUMBING·HEATING

● There is a vast difference between STREAMLINE Copper Pipe and ordinary commercial copper pipe or tubing. STREAMLINE Copper Pipe is made from the finest material obtainable. It is under laboratory control from raw material to finished product. It is a greatly improved pipe of uniform diameter and consistently close tolerance. It is made particularly for use with solder type fittings, and specifically for use with STREAMLINE Solder Fittings.

There is no material as modern and practical as STREAMLINE Copper Pipe and Solder Fittings for piping jobs—nor can you use anything more satisfactory to yourself and customers, whether it be for plumbing and heating conducting systems or for the manufacture of air conditioning equipment.

STREAMLINE Copper Pipe and Fittings are the ideal material for concealed convection type heaters, unit heater coils, gas fired type boilers, indirect water heaters, booster heater coils, humidifiers, dehumidifiers, condensers, and the multitude of other uses.

STREAMLINE Copper Pipe is eminently satisfactory for most any solder type fittings, but for uniformly perfect jobs, and for continuously satisfactory results, it should be used with STREAMLINE Solder Fittings—one is the perfect complement of the other.

Standardize on STREAMLINE, both fittings and pipe, for hot and cold water lines, vapor or steam heating lines; and for air conditioning, cooling water lines, refrigerant and condensate drain lines.

STREAMLINE Solder Fittings are manufactured in complete range from 1/4" to 12" inclusive. Use STREAMLINE Copper Pipe, connect it with STREAMLINE Fittings . . . ALWAYS.

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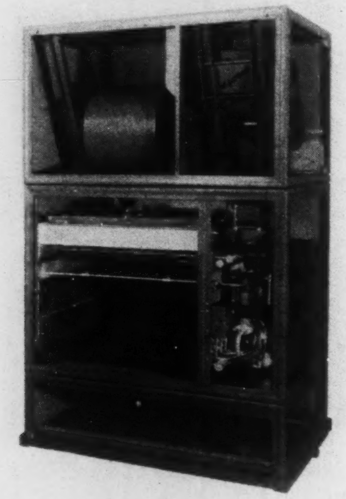
Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 135.

Announces New Air Conditioners

No. 1399—In about half the floor space, and at a lower cost, new "Yorkaire" self-contained air conditioners deliver the same capacities the maker's first unit offered. The new units are designed for commercial installations, have standard "Balanseal" compressors with standard motors and drives. Features include:



Patented "Balanseal" which is said to cut power costs because it cuts friction losses to a minimum.

Full opening valves to eliminate valve trouble.

Short crankshaft to reduce whip and bending, cutting friction and noise.

Special piston rings to seal pistons tightly.

Patented "centriforce oiler" to eliminate lubrication failure.

Stainless steel grilles to simplify control of air distribution and provide the advantage of directed air flow to meet particular requirements.

These units will be shipped and handled in sections. The bottom section contains the complete refrigeration system and cooling coil, so that the system is shipped completely charged with refrigerant. To install the units it is only necessary to set them in place, and make electrical, water, and drain connections.

The line is adapted for "back against the wall" installations, as well as at island positions in large spaces and at corners in L-shaped premises.

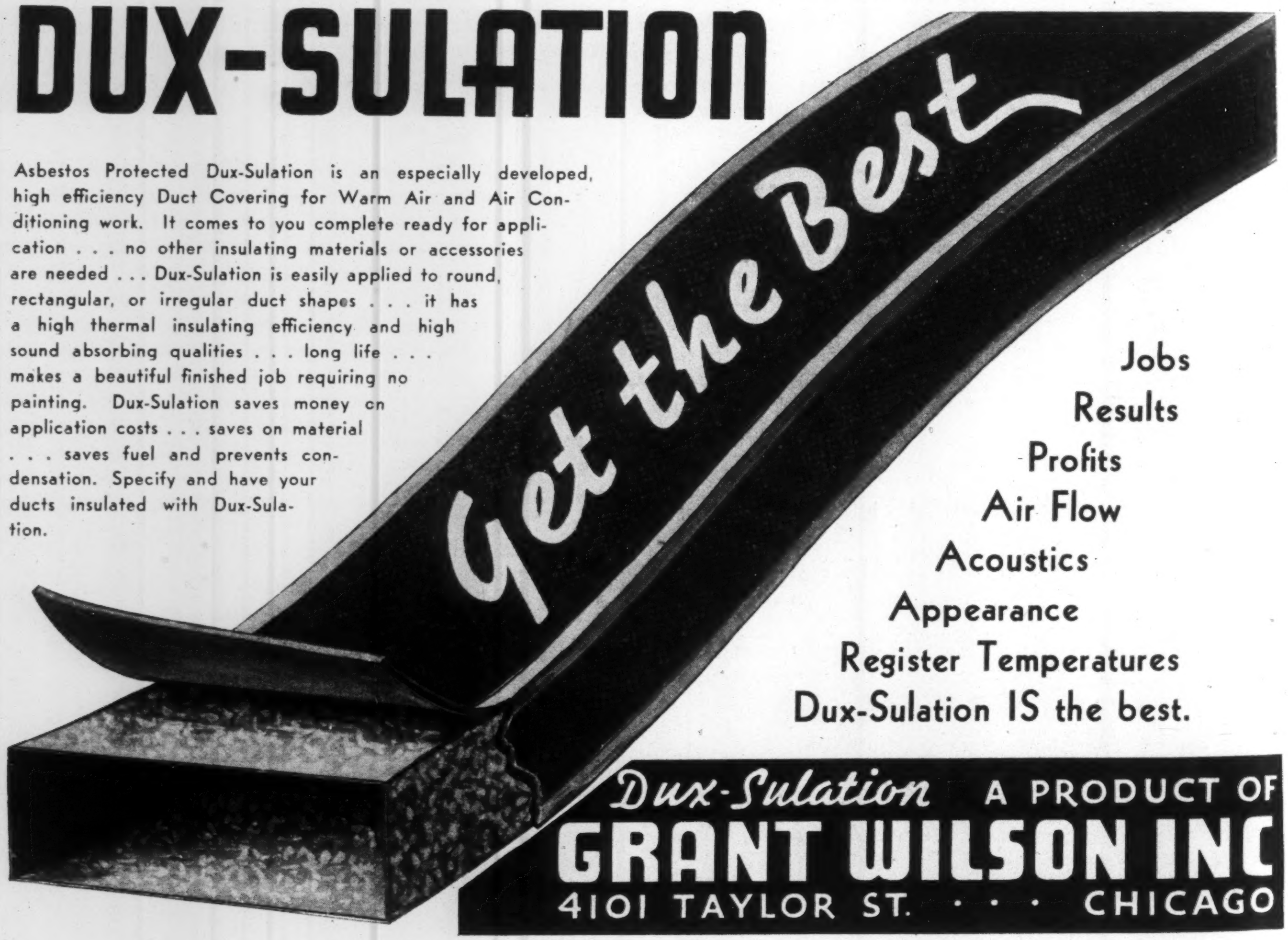
New sectional air conditioners (illustrated) include units of the finned coil type for comfort applications, dry coil type equipment for industrial applications, spray type and wetted surface conditioners for packing plants and similar requirements, and economizers. Paralleling the re-design of these air handling units, a new series of finned coils for direct expansion "Freon-12," chilled water, or non-electrolytic brine applications have been developed. They are arranged for floor or ceiling mounting, and may be installed within the conditioned space or at a remote location with the proper duct system.

Also announced is a portable conditioner which features an adjustable rotary grille to diffuse the conditioned air through the room to meet individual preferences and room characteristics. It is housed in a cabinet styled by Walter Dorwin Teague.

Outdoor air is introduced through an adjustable damper. Both the outdoor air and recirculated air are passed through a special filter. —York Ice Machinery Corp., Roosevelt Ave., York, Pa.

New Forged Steel Stop Valves Available

No. 1400**—New stop valves for high pressure service are made from a single block of forged steel in sizes from 2½ to 8



DUX-SULATION

Asbestos Protected Dux-Sulation is an especially developed, high efficiency Duct Covering for Warm Air and Air Conditioning work. It comes to you complete ready for application . . . no other insulating materials or accessories are needed . . . Dux-Sulation is easily applied to round, rectangular, or irregular duct shapes . . . it has a high thermal insulating efficiency and high sound absorbing qualities . . . long life . . . makes a beautiful finished job requiring no painting. Dux-Sulation saves money on application costs . . . saves on material . . . saves fuel and prevents condensation. Specify and have your ducts insulated with Dux-Sulation.

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ONE-WAY PUZZLE?

THIS "puzzle" reads across all right—but down, not so good. It's the same way with some underground steam conduit systems. On the surface they look O. K.—but when you go *down* into fundamentals they just don't make sense. Certain *exclusive* features in Ric-wiL design are vital to the successful performance of underground steam lines. Be sure you get *genuine* Ric-wiL with *genuine* Dry-paC asbestos insulation. That's a combination that reads right and *is* right—any way you look at it!

Ric-wiL is the most dependable and successful underground conduit on the market. Various types in Tile and Cast Iron to meet every condition. A quarter century of experience with underground steam problems gives Ric-wiL engineers a decided advantage in serving YOU. Ric-wiL's basic features—*closed construction*, adequate drainage, Loc-liP side joints, special pipe supports, incomparable Dry-paC insulation, and many others—are essential to satisfactory performance. For genuine economy—get genuine Ric-wiL. Latest Bulletins on request.

The Ric-wiL Co., Union Trust Bldg., Cleveland, Ohio
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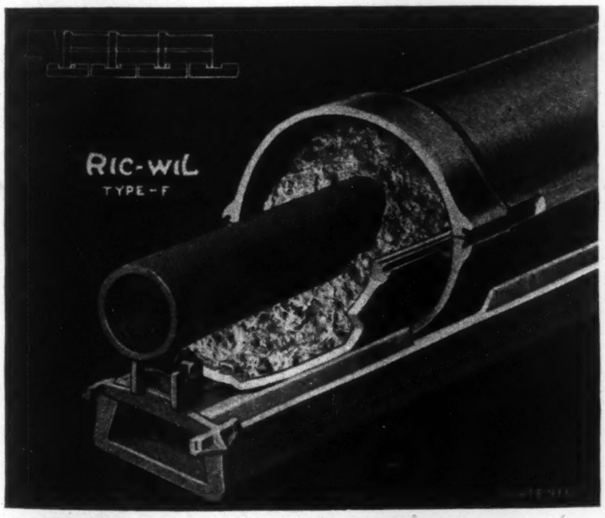
Ric-wiL is built by skilled craftsmen of long experience, on Ric-wiL products exclusively.



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ENGINEERING EXPERIENCE

During the past twelve years U. S. AIRCO has designed and built the equipment for more than 6,000 air conditioning installations, many of them its own complete systems. It has won and maintained a position of leadership in the theatre field,—the most difficult of all air conditioning problems.

A COMPLETE LINE

U. S. AIRCO makes blowers in all sizes and types, single and double stage air washers in all sizes, unit heaters, unit air conditioners, small store package units, portable room units, deflecto-grilles, propeller fans, attic fans, humidifiers, etc.

WRITE US NOW

—for the U. S. AIRCO catalog, if you are interested in the sales possibilities of the U. S. AIRCO line. Please give full information about yourself, lines handled, territory covered, previous experience in air conditioning.

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UNITED STATES AIR CONDITIONING CORPORATION
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2135 Kennedy St. N. E., Minneapolis, Minnesota

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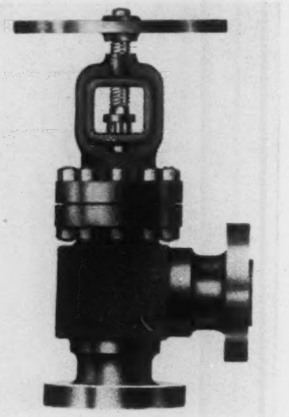
in. and for pressures up to 2500 lb per sq in. They can be furnished with flanged ends or with ends prepared for any type of welding. They are also made in both angle and offset types and are produced in conformity with A.S.M.E. specifications.



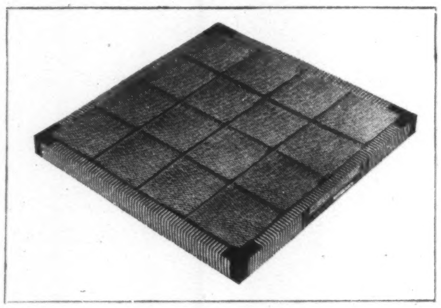
An unusual feature of the offset valve, which is of the unidirectional type, is that its pressure drop approaches that of a gate valve, according to the maker. An internal bypass is provided, a desirable feature for high pressure service.

The bodies, flanges, and bonnets are all hammer forged from chrome molybdenum steel, all seats are stellite faced, bolting is of class C, A.S.T.M. steel, and the trim is of stainless steel.—Clees Valve & Engrg. Co., 90 West St., New York, N. Y.

Offers New Throw Away Filter

No. 1401**—A new throw away type air filter for warm air furnaces, ventilating and air conditioning systems, air compressors, and internal combustion engines has just been developed.

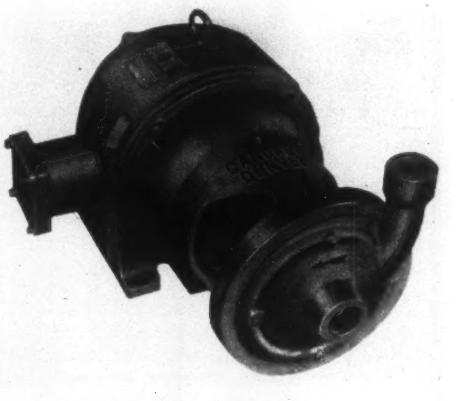
In this filter, air is cleaned as it impinges against layers of expanded fiber. These layers have been sprayed with a sticky compound that retains dust and pollen. Three sections—a coarse, medium, and fine mesh—make up the completed filter. Each section consists of seven layers of the expanded fiber.



Because the mesh of the filter baffles gets progressively finer and because the stickiness increases progressively as the air travels through the filter, there is little danger of surface clogging, and dust is deposited uniformly throughout the entire filter, according to the maker. This, and the large surface area, assures high dust holding capacity. Tests indicate that the filter will hold 132 grams of standard dust for every square foot of frontal area.

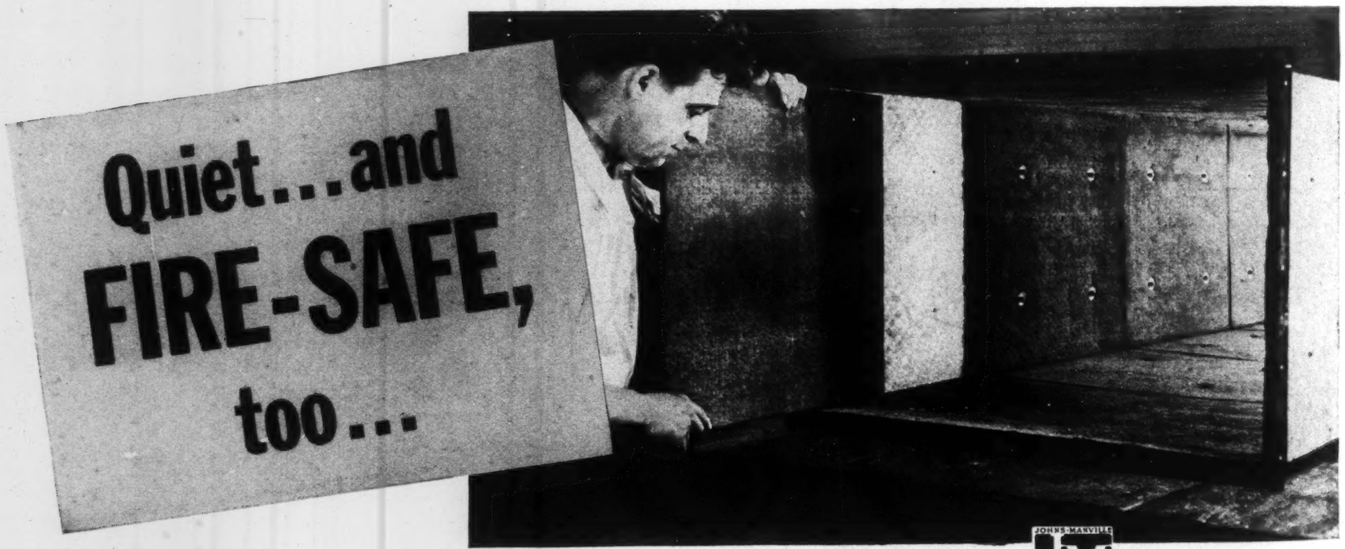
Air flowing through the filter follows a tortuous path, changing its direction 21 times. Hence, the filter's efficiency is high, depending upon the size of the dust. In removing pollen, its efficiency is 97½ per cent, it is stated.—C. F. Burgess Laboratories, Inc., 111 W. Monroe St., Chicago, Ill.

Pumping Unit Is Compact



No. 1402—New close coupled centrifugal motor pump is designed for capacities up to 250 gpm and heads up to 250 ft at speeds of 1750 and 3460 rpm; the speed depends upon the required capacity and head.

The pump is



NO SMALL MATTER, the additional factor of fire-safety . . . when lining air-conditioning ducts for sound absorption! Bulletins from the National Board of Fire Underwriters report cases where expensive damage was caused by the absence of this protection.

To make sure *your* air-conditioning ducts will never contribute to fire spread, line them with Johns-Manville Airacoustic Sheets. This material has a rate of sound absorption as high as 80% . . . and provides a high degree of fire-safety as well.

Moreover, J-M Airacoustic Sheets provide many other advantages. Permanence, by virtue of their mineral composition . . . resistance to moisture . . . low thermal conductivity . . . light weight . . . and a smooth surface that means low frictional resistance.

For complete details on J-M Airacoustic Sheets, write Johns-Manville, 22 E. 40th St., New York, N. Y.

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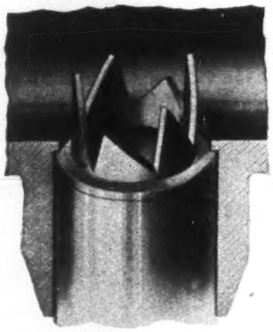
AIRACOUSTIC SHEETS

For Duct Lining

…AND DON'T FORGET THE SPECIAL FEATURES OF

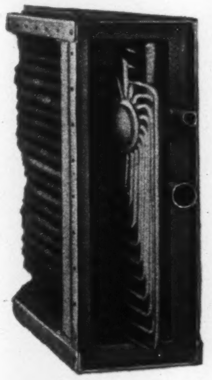
AEROFIN Heat Exchange Surface



Crown Orifice

For Flexitube Heating Units

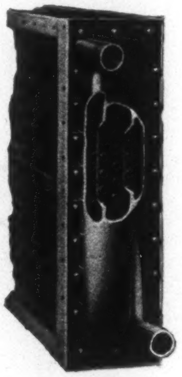
This patented orifice having sharp projecting points is assembled in each tube to break up scale carried along in the steam line and to stop clogging. Danger of freezing due to faulty distribution of steam is thus eliminated.



Centrifugal Header

For Direct Expansion Units

This patented centrifugal header, a product of extensive research and field tests, saves costs on installation, is simple, fool-proof and properly distributes the refrigerant through all circuits of the coil.



Cleanable Tube Units With Removable Headers

For Water Cooling

The headers being removable permit easy cleaning of tube interiors. They are particularly valuable when sediment or scale-forming chemicals are present in the cooling water.

Special features such as these are present in all Aerofin heat exchange surface, making it the logical choice of engineers, architects and air conditioning contractors. *Send for technical literature or consult any of our district offices, shown below, for the solution of your particular problem.*

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In the Pennsylvania Hotel, for instance, where uninterrupted 24-hour service is demanded, Fairbanks Valves installed in 1918 are still operating satisfactorily.

Quality in a valve is hard to see, but long usage is sure to show up any defects.

To make sure that your jobs will give satisfaction, install Fairbanks Valves.

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396 Lafayette St., New York, N. Y.
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MANAGEMENT CO. MODERNIZES HEATING IN HANNA BUILDING

Uses Webster Moderator System to Heat 16-Story Building and 8-Story Annex

OVERCOME HEATING TROUBLES

T. W. Grogan Co. Places Webster System in Second Cleveland Building in Single Year

MODERNIZE RADIATOR TRAPS

Cleveland, O.—How the T. W. Grogan Company, a nationally known management organization, used the Webster Moderator System of Steam Heating to keep tenants satisfied and reduce operating costs is shown in the heating performance record of the Hanna Building and Annex in downtown Cleveland.

With the installation of the new control system during the 1934-35 season, the heating of the Hanna Building and Annex was divided into four heating zones. Separate operating schedules for each zone, made possible by manual controls, take care of the diverse heating needs of a theatre, a restaurant, a drug store and the office suites.

Hanna Building and Annex, Cleveland, O.

The modernization included new interiors for the traps on all radiators.

The Hanna Building, with its 1,647 radiators and 56,357 square feet of installed direct radiation, is the second large Cleveland building under the management of the T. W. Grogan Company to install a Webster Moderator System. It followed by a few months the completion of a similar program in the Rockefeller Building.

Both in the Hanna Building and in the Rockefeller Building, the Smith & Oby Co., Inc., prominent Cleveland heating contractors, did all the installation work.

These before-and-after facts point the way to maximum comfort and economy in heating new buildings as well as in modernization of existing installations. Consult your architect, engineer or heating contractor. Or address

WEBSTER MODERATOR CONTROL "Control-by-the-weather"

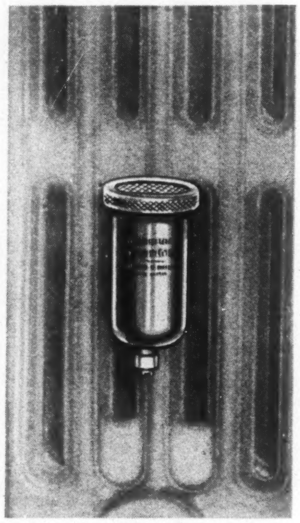
1888 WARREN WEBSTER & CO., CAMDEN, N. J. 1938
Pioneers of Modern Steam Heating
50 YEARS OF HEATING PROGRESS

Representatives in 60 principal U. S. Cities

single suction, having a single stage enclosed impeller of standard bronze. The pump and splash proof motor are mounted together to form a complete, compact unit. An adjustable bearing in the outboard end of the motor compensates for wear between the clearance spaces in the pump. Because no wearing rings are needed in this type of construction, they have been eliminated.

The pumps can be installed in any position; on the floor, on the wall or on the ceiling and either horizontally or vertically. —Gardner-Denver Co., Quincy, Ill.

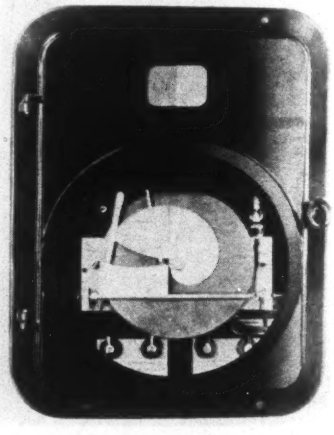
Humidifying Air Valve Improved



No. 1403—Combination automatic humidifier and air vent valve for steam heated apartments, offices, and homes discharges 1 pint of vapor per hr with steam pressure at ½ lb in the radiator. Installation is made by simply removing standard air vent valve from the radiator and screwing the humidifier valve in its place.

Steam is filtered and deodorized by two asbestos filters, a silencer and screen. By means of a simple adjustment, the amount of vapor discharged may be controlled to prevent over saturation of air during extremely cold weather.—Maid-O'-Mist, Inc., 180 North Wacker Dr., Chicago, Ill.

Instrument Telemeters Electrical Units

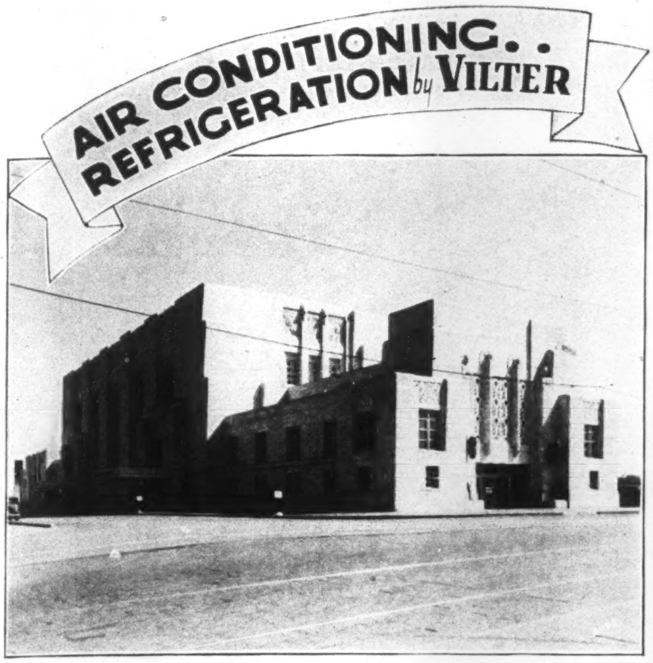


No. 1404—Electrical units such as volts, amperes, and watts are accurately measured and transmitted to a remote point by means of the "Metameter." New features included in the design of these instruments have made it practical to apply this system of telemetering to electrical measurements, using standard measuring elements. They have now been adapted to measuring and telemetering electrical measurements of all magnitudes—from small millivoltages up to the totalized power output of power plants.

The principle involved has been used for a number of years in transmitting readings of pressure, temperature, flow, mechanical motion, etc., from a transmitter at the point of measurement to a receiver, which is a recording or indicating instrument, at some distance away—a few feet or many miles. A cam driven by a constant speed motor gives the electrical impulses required to operate the system. This device is designed so that as it periodically engages and releases the pointer arm of the measuring element, no strain is placed on the element.—Bristol Co., Platts Bridge, Waterbury, Conn.

New Ball and Roller Bearings Offered

No. 1405—Distinctive feature of new ball and roller precision bearings is the use of a wide inner ring of double row bearing



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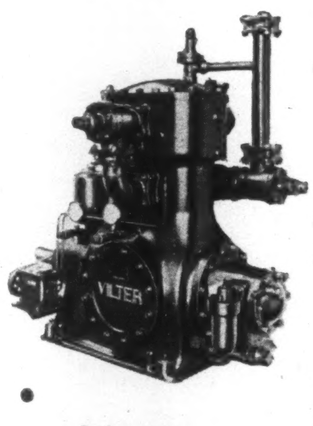
Engineers, enjoying the confidence of the Air Conditioning and Refrigeration Industry, look primarily for RESULTS in their equipment-choice. On this basis Vilter has won their respect and enthusiastic praise.

Office buildings, important public buildings, theatres, factories and stores, all Vilter-equipped, prove our story of well-planned efficiency, with their low operating cost, minimum maintenance expense, and long life in operation. Let us show you how you, too, will profit by listing Vilter Equipment on your Air Conditioning specifications.



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"FREON - 12"
Compressors

Two Outstanding Major Improvements Exclusive With Vilter

- New and Revolutionary Rotary Shaft Seal gives positive protection against leakage.
- Less Horsepower requirements Per Ton is provided by reducing all friction to a minimum.

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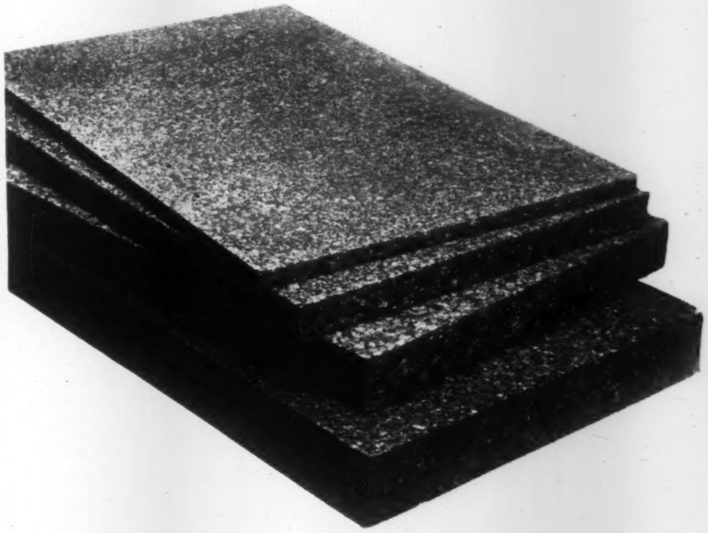
Superior Since 1867
VILTER
Air Conditioning
Refrigeration . . .

THE VILTER MANUFACTURING CO.
2148 SOUTH FIRST STREET
MILWAUKEE, WISCONSIN

CORK INSULATED DUCTS DELIVER COOL AIR

More efficiently—at lower cost



In cork, nature has combined all the essential physical characteristics necessary for efficient and economical insulation. That's why Novoid Corkboard, made from pure cork granules, is the ideal material for insulating cool air ducts and other parts of air conditioning and ventilating systems.

Because of its unique physical structure, Novoid Corkboard forms an impenetrable barrier to the passage of heat. When surfaced with "Stonewall Plastic Finish," it is impervious to air and moisture infiltration and guards against condensation. Novoid is structurally strong, light in weight, and easily applied to round, square, or rectangular ducts.

For insulating air washing rooms, Novoid Corkboard is equally efficient, and prevents the costly infiltration of warm air. It will pay you to find out all the facts concerning Novoid Corkboard and Novoid Cork Pipe Covering. Mail the coupon today for complete information. Cork Import Corporation, 330 West 42nd Street, New York City.

NOVOID CORKBOARD INSULATION

MAIL THE HANDY COUPON TODAY

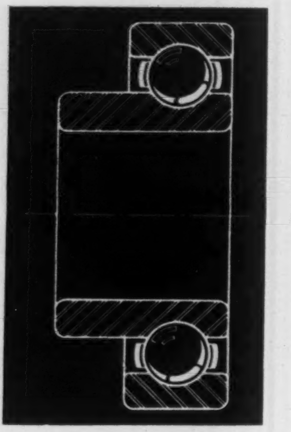
Cork Import Corporation
330 West 42nd Street, New York City

Please send me full information concerning Novoid Corkboard and Cork Pipe Covering for insulating air conditioning systems.

Name ....

Street ....

City and State..



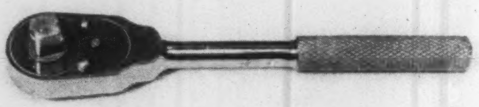
width, in combination with an outer ring of single row width.

They have been designed primarily for opposed mounting in electric motors and similar equipment, the wide inner ring insuring a better sealing on the shaft. In many cases also it avoids the necessity for threading the shaft and applying lock nuts or other locking devices. This elimination of threads permits a larger shaft extension diameter for a given bearing bore and also avoids weakening of the shaft by threading, the maker states.

The ball bearings are available in the medium metric series, from 25 to 55 m/m bore. The cylindrical roller bearings with one lipped outer ring are available in the medium metric series, from 30 to 130 m/m bore.—Norma-Hoffman Bearings Corp., Stamford, Conn.

Ratchet Handle Is Reversible

No. 1406—New reversible ratchet handle for ⅜ in. square drive sockets and attachments is light in weight, strong and perfectly balanced, the maker states. In order to keep out dust, dirt, grit and grease the ratchet is fully enclosed.

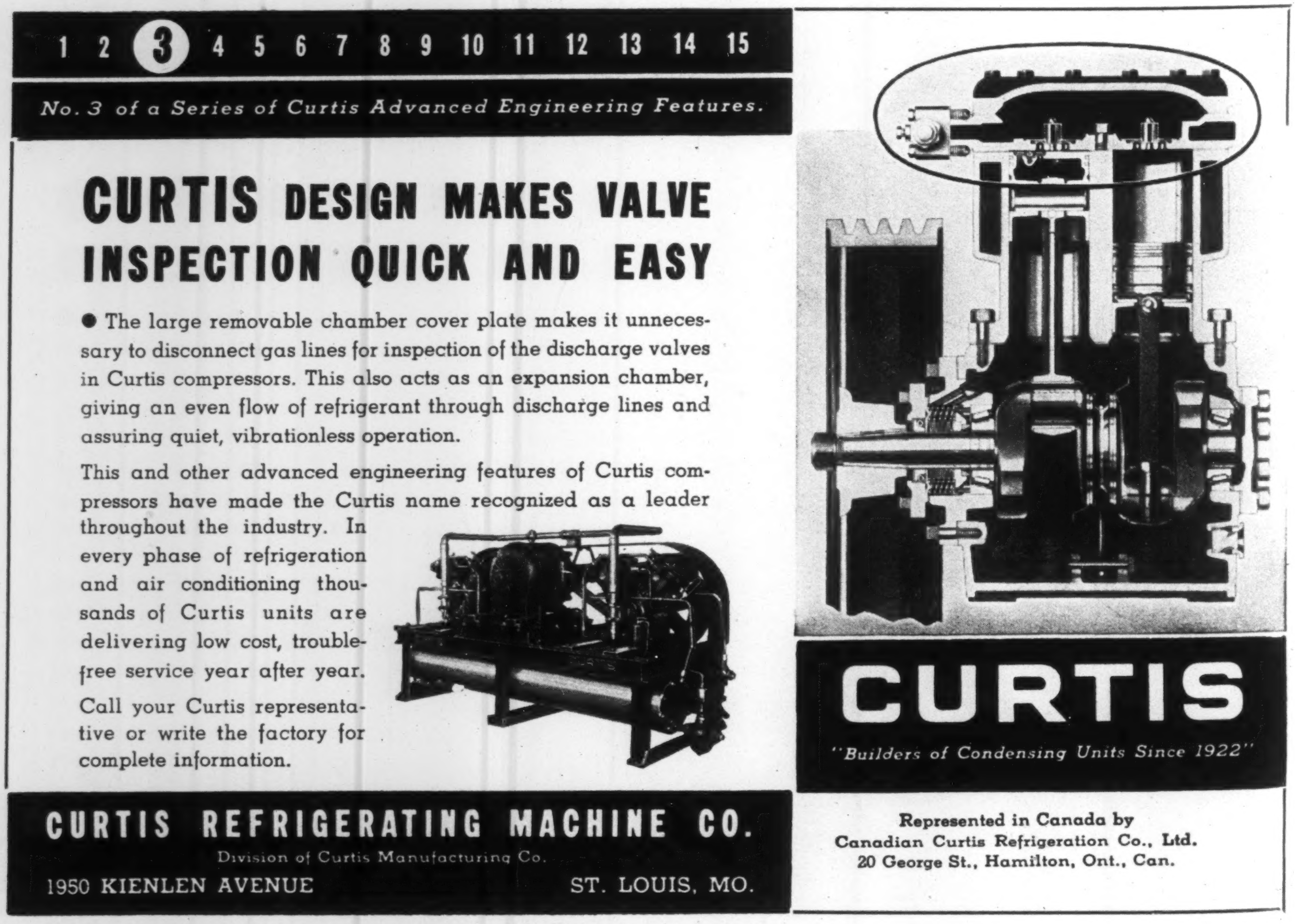


The ⅜ in. lug makes it adaptable for use with all ⅜ in. square drive sockets and attachments. On the other side of the head is a ¼ in. square opening for use with ¼ in. adapters or for use on small compressors, motors, shut-off valves, etc.

Made of chrome-vanadium steel, chromium plated and highly polished, it has a round knurled handle to insure a firm, comfortable grip.—Bonney Forge & Tool Works, Tilghman St. & Meadow St., Allentown, Pa.

Selective Pressure Control System for Heating

No. 1407—A new selective pressure control system for low pressure boiler installations was displayed publicly for the first time at the Fifth International Heating and Ventilating Exposition last month. By this method the control is applied to fuel burning, and is either automatic or manual. By controlling combustion, the steam pressure in the boiler, as well as in the



1 2 ③ 4 5 6 7 8 9 10 11 12 13 14 15

No. 3 of a Series of Curtis Advanced Engineering Features.

CURTIS DESIGN MAKES VALVE INSPECTION QUICK AND EASY

● The large removable chamber cover plate makes it unnecessary to disconnect gas lines for inspection of the discharge valves in Curtis compressors. This also acts as an expansion chamber, giving an even flow of refrigerant through discharge lines and assuring quiet, vibrationless operation.

This and other advanced engineering features of Curtis compressors have made the Curtis name recognized as a leader throughout the industry. In every phase of refrigeration and air conditioning thousands of Curtis units are delivering low cost, trouble-free service year after year.

Call your Curtis representative or write the factory for complete information.

CURTIS REFRIGERATING MACHINE CO.
Division of Curtis Manufacturing Co.
1950 KIENLEN AVENUE ST. LOUIS, MO.

CURTIS
"Builders of Condensing Units Since 1922"

Represented in Canada by
Canadian Curtis Refrigeration Co., Ltd.
20 George St., Hamilton, Ont., Can.

The Welded Steel Burnham ranges in capacities from 1800 to 42,500 sq. ft.

The Cast Iron Burnham is made in twin sections so it can be passed through any average door. No tearing out necessary. Used extensively for replacements.

Hank

Talks Hoss Sense About Two Donkies That Ain't

Ever do any figuring on a piece of paper, or maybe a board, what raising the devil more'n you need, costs the feller who pays the bills? Meaning mostly the two donkies—*tearing out* and *tearing down*, when neither is needed doing.

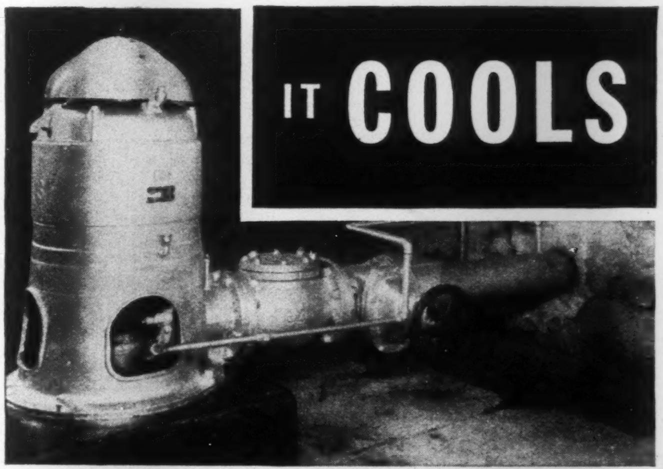
Take the replacing of steel boilers. Why get so all het up, busting a big hole in the building, to get the gol durn old boiler out, and making the hole maybe bigger even yet to get another big steel boiler back in? Most boilers are not setting in places so alfired crowded, they can't be just pushed aside. Then you can move in a Burnham Twin Section through the same door you cum in yourself, and not even nick the frame so much as any.

'Course, if you are friendlier fur a steel boiler than a cast iron, then that's another hoss the same color. Being as how we make both steel and cast iron, we favor 'em both. Both are built to a *specification* and a *reputation*. Some makes of boilers only has the specification. Which ain't enuff for engineering fellers like you.

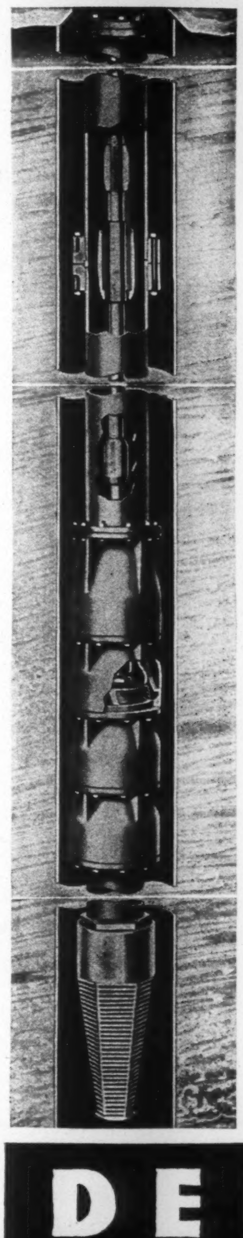
Hank Hindle

Burnham Boiler Corporation
Manufacturers of Heating Equipment
Since 1873
IRVINGTON, NEW YORK ZANESVILLE, OHIO
Export Department, 116 Broad Street
New York

Burnham Boiler



IT COOLS



IT SAVES

DEMING DEEP WELL TURBINE PUMP PROVES ITS ABILITY TO CUT AIR COOLING COSTS

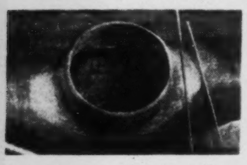
Where well water with temperatures not exceeding 57° F. is available, Deming Turbine Pumps provide a highly efficient and economical solution to many air cooling problems. Even where bad water conditions of a corrosive nature exist, Deming Turbines are operating successfully.

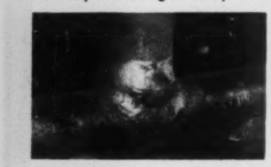
Among the many important features of these pumps are *water lubrication, cutless rubber bearings* and the *adjustable impeller clearance* feature which makes it possible to sustain the original high efficiencies by easily made adjustments from the surface.

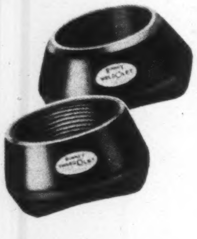
Investigate Deming Deep Well Turbine Pumps for air cooling applications. Send for descriptive literature.

DEMING
Pumps
THE DEMING CO. • SALEM, OHIO

NO THREADING
CUTTING
NO FITTING







NNEY
WELDOLETS
THREDOLETS

. . . Welded Outlets for Piping . . .

'eldOlets and ThredO-
ts are easily installed.
mply select the position
the outlet, rub the fitting
'er the pipe several times
remove scale, mark center
ies and tack the WeldO-
t or ThredOlet into po-
ion.

ie WeldOlet or ThredO-
t is then welded into
ace either by the electric-
c or oxy-acetylene meth-
d. A junction of full pipe
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leak-proof is the result.

'here the outlet is 2" or
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at the button be removed
ter the welding operation.
'n small sizes, the fitting
used as a templet and the
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st. A full inspection of
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ossible by using these fit-
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scale, welding metal, etc.

ie branch line is then
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simple Vee weld. In the
ent that a ThredOlet is
ed the branch pipe is
readed and screwed into
ace. The result is a junc-
on of full pipe strength,
solutely leak-proof with
rbulence and friction re-
iced to a minimum.

The Modern Method
..of Making Branch Connections

BONNEY WeldOlets and ThredOlets provide the modern method of making branch pipe connections by welding.

They eliminate all cutting, threading and fitting of the main pipe. No templets are needed. The illustrations to the left show the ease with which they are installed.

WeldOlets and ThredOlets produce leak-proof joints of full pipe strength. Their funnel shaped outlets reduce turbulence and friction to a minimum. Available from stock with outlets from 1/4" to 12" for all standard pipe sizes, they cost no more than ordinary fittings and much less to install.

Stock fittings are of drop-forged steel, but special applications sometimes require special materials. They can be made of Toncan iron, wrought iron, brass, Everdur, Monel, Stainless Steel, in fact any metal that can be forged.

Once seen, their advantages are obvious. To show them to you we'd like to send a sample—no obligation, of course. Sign the coupon and attach to your company letterhead, and you'll use them on your next piping job.

The names "WeldOlets" and "ThredOlets" are Bonney trade marks registered in the United States Patent Office. Full patent coverage has been granted in the United States and foreign countries.

BONNEY FORGE & TOOL WORKS
Forged Fittings Division
ALLENTOWN, PA.
Stocked by Leading Distributors

Bulletin WT23 tells the complete story about WeldOlets and ThredOlets. The coupon will bring your copy and a sample trial fitting. Mail it today.

Yes, I'd like a sample WeldOlet or ThredOlet. Also send Bulletin WT23 and name of nearest distributor.
HP&AC-28
Name . . . .
St. & No. . . . .

supply piping and radiators, can be maintained above, at, or below atmospheric pressure as heat requirements dictate. According to the manufacturer, only sufficient fuel is burned to maintain the required selected steam pressures. Such control is practical only when the vacuum pump is also automatically controlled and coordinated to produce the maximum vacuum possible for the temperature conditions existing at the pump, says the manufacturer.

With the system, it is stated, an improved and simplified flexible method of controlling steam circulation over a wide range of pressures and temperatures is made possible. The heat emission of radiators is controllably balanced against the heat loss of a building, according to weather requirements, even to the extent of providing intermittent shots of steam at low absolute pressures to all radiators when only a minimum amount of heat is required.

The controller is installed in the return piping close to the vacuum pump and is actuated by the fluid temperature pressure at this point. The selective controller automatically operates the pump with a "cut in, cut out" range adjustable to the requirements of the system. The controller operates automatically to insure proper differential between supply and return main pressures.—Illinois Engineering Co., 2035 S. Racine Ave., Chicago, Ill.

New Line of Cooling Units Announced

No. 1409—New "Koolroom" line of units consists of seven models from a 1/3 hp type for window sill use to a 1½ hp console. The units are self-contained in finished steel cabinets. These units dehumidify, clean, circulate and ventilate.

The largest of the models circulates 600 cfm and has a rating of 19,000 Btu per hr. Regularly supplied with 1½ hp repulsion induction type motor, 220 volt, 60 cycle a-c, it may be had with direct current and odd frequency motors at slight additional cost. Its height is 41 in., width 36 in. and depth 24 in.

The small window sill model is air cooled, the others being water cooled. It has a rating of 4000 Btu per hr, circulates 200 cfm of air and is equipped with a ⅓ hp, 110 volt, 60 cycle a-c motor, although other motors may be had. Its height is 17 in., width 23 in., and depth 29 in.—Indian Trailer Corp., Koolroom Div., 2338 Indiana Ave., Chicago, Ill.

Offers Evaporative Condensers

No. 1410—A recently announced evaporative condenser will reduce air conditioning water costs more than 90 per cent, according to the manufacturer. Among its features are unit construction which lowers installation cost, an all rust resisting galvannealed steel cabinet, coils which are readily accessible for cleaning, and ample fan capacity for circulating and cooling.

This condenser achieves its cooling effect by distributing water over fin type condenser coils through which the warm refrigerant gas flows. The fins are spaced to permit easy cleaning with a steel brush, and are scientifically designed in relation to the prime

These OFFICES

are examples of the great variety of business places successfully

AIR CONDITIONED BY CARBONDALE

COMPLETE COMFORT

means...

- Increased employee output
- More business
- Greater profit

Carbondale air conditioning equipment has new and valuable capacity control features. A Carbondale engineer, backed by an organization with 37 years of experience in this field, will be glad to explain them to you . . . and to cooperate fully in the solution of your air conditioning problems. There is no obligation.

CARBONDALE
DIVISION
WORTHINGTON PUMP AND MACHINERY CORPORATION
General Offices: HARRISON, NEW JERSEY
CA7-36
Offices and Representatives in Principal Cities

CARBONDALE

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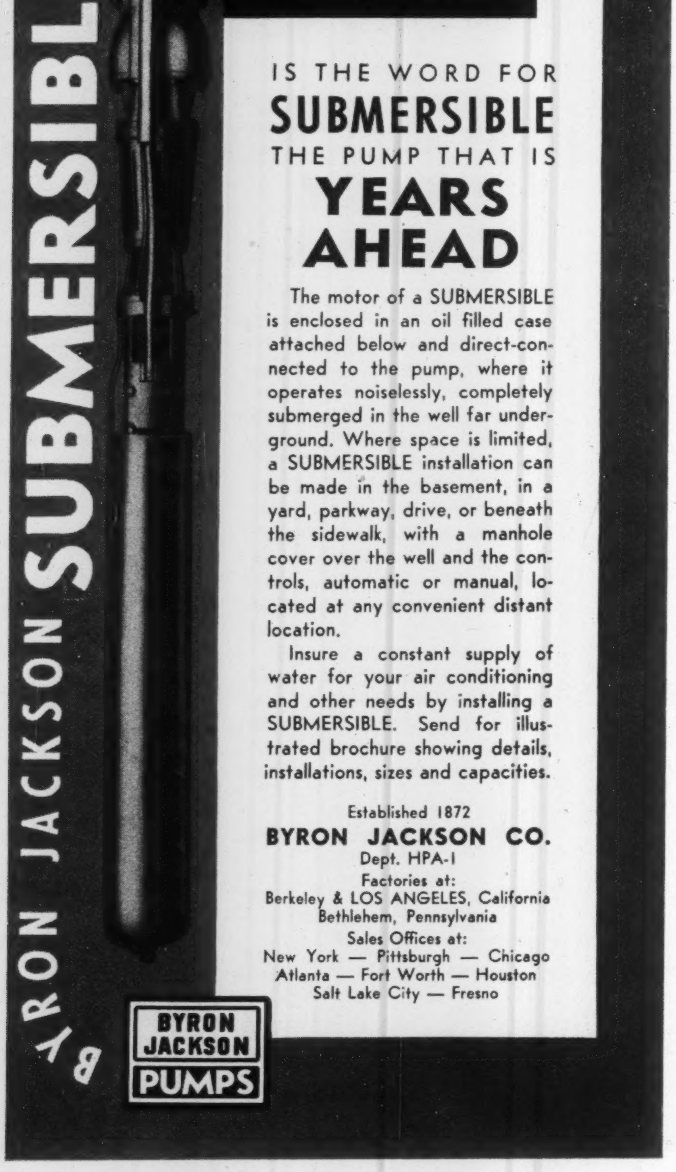
valves
controls . . .
are
DEPENDABLE

AUTOMATIC PRODUCTS COMPANY
2460 North 32nd Street
MILWAUKEE, WISCONSIN

Expansion Valves . . . Solenoids . . . for Refrigerants . . . Gas . . Water . . Oil . . Available in all Capacities . . . for Your 1938 Catalogue . . . Sales Plans . . . New Products . . . New Installations . . .



IS THE WORD FOR
SUBMERSIBLE
THE PUMP THAT IS
YEARS AHEAD

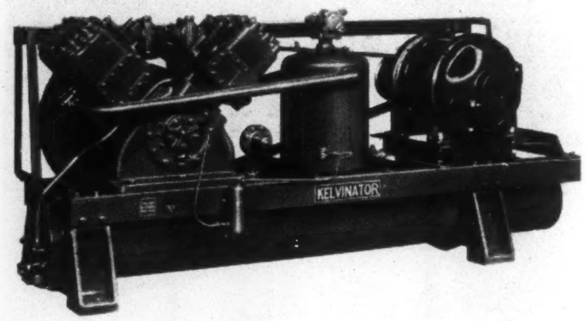
The motor of a SUBMERSIBLE is enclosed in an oil filled case attached below and direct-connected to the pump, where it operates noiselessly, completely submerged in the well far underground. Where space is limited, a SUBMERSIBLE installation can be made in the basement, in a yard, parkway, drive, or beneath the sidewalk, with a manhole cover over the well and the controls, automatic or manual, located at any convenient distant location.

Insure a constant supply of water for your air conditioning and other needs by installing a SUBMERSIBLE. Send for illustrated brochure showing details, installations, sizes and capacities.

Established 1872
BYRON JACKSON CO.
Dept. HPA-1
Factories at:
Berkeley & LOS ANGELES, California
Bethlehem, Pennsylvania
Sales Offices at:
New York — Pittsburgh — Chicago
Atlanta — Fort Worth — Houston
Salt Lake City — Fresno

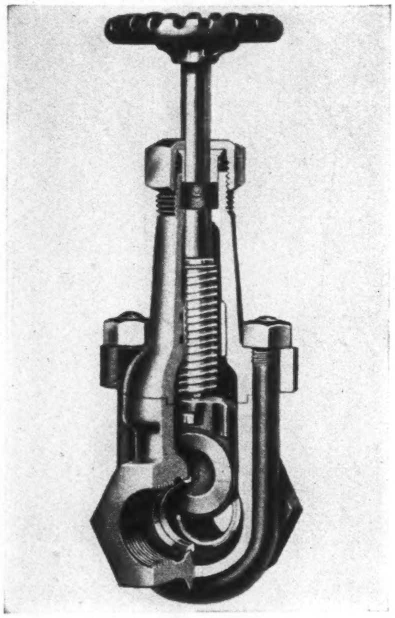
BYRON JACKSON
PUMPS

surface of the coil. Spray discs are used, eliminating the need of a water pump, which feature insures a fixed quantity of water at all times without the need of periodical adjustment and cleaning. Water directional fins adjacent to the rotating discs catch the water picked up by the discs, breaking it up into a fine shower over the condenser coil. Units are available in a range of capacities from 5 to 20 tons of refrigeration. The compressor units (illustrated) offered with them incorporate a coil which first uses the water for subcooling the refrigerant.—Kelvinator Div., Nash-Kelvinator Corp., 14250 Plymouth Rd., Detroit, Mich.



New Gate Valve Has Many Features

No. 1411—A new U-bolt gate valve for 150 lb steam working pressure and 225 lb gas and liquid pressure incorporates several features, such as relief slots which permit drainage back into the body chamber and eliminate the possibility of freezing or clogging above the bonnet threads. According to the maker, the valve is especially adapted for service in the chemical, paper, gas, and petroleum industries, as well as for ordinary steam, water and air lines.



This valve is made with an iron body, bronze mounted, and in all iron. Available sizes range from ½ to 4 in. — Fairbanks Co., 396 Lafayette St., New York, N. Y.

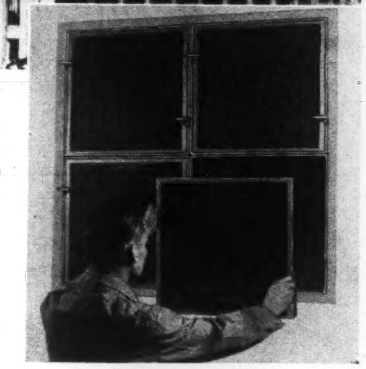
Asbestos Covered Insulation Board Announced

No. 1412—A new asbestos covered insulation board called "Cemesto" has a core of standard "Celotex" board to which asbestos surfaces are bonded. According to the manufacturer, the combination of rigid insulation and asbestos makes for partitions which are leak proof in relation to heat and cold. The adhesive used for bonding is stated to be moisture proof and highly vapor resistant.

Applications include uses in the construction of industrial conditioning, drying and processing rooms, partitions, and for other building uses where heat and humidity resistance are essential. The board can be exposed to outside weather.

The board is furnished in standard sizes 4 ft wide by 6, 8, 10, and 12 ft long, with special sizes available on request. The asbestos cement surfaces may be had on one or both sides, the overall thicknesses for the first ranging from ⅝ in. to 2⅛ in., and

Graham, Anderson,
Probst & White — Architects



CLEVELAND'S UNION TRUST BUILDING

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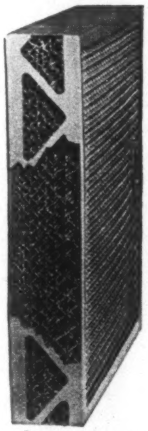
ANOTHER PROMINENT USER OF

AIR-MAZE FILTER PANELS



Open end cut-away view

Scientific design combined with precision construction has made AIR-MAZE air filter panels the choice of many leading commercial buildings. Exact and uniform progressions of density in the unique filter element assure *even collection and pyramiding* of all dust, grit and pollens. This means unusual ease of cleaning and *no clogged areas.* Write today for bulletin GPB-97.

These features will solve your filter problems

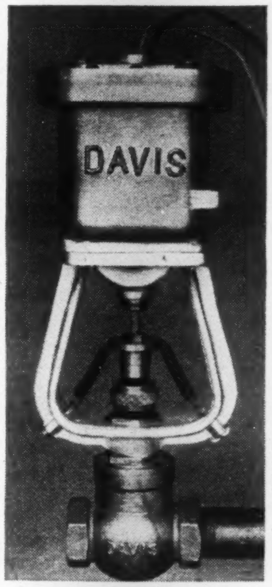
- 99.83% air cleaning efficiency.
- Easily cleaned and charged.
- No replacements needed.
- Very low pressure drop.
- Long, economical service.

See AIR-MAZE in the A. S. H. & V. E. Guide Book

AIR-MAZE CORPORATION
820 Huron Road Cleveland, Ohio

AIR-MAZE
CLEANABLE AIR FILTER PANELS

SOLENOID VALVES



The No. 90 Solenoid Valve pictured above is a simple general purpose balanced disc type. No. 99 is a single seat valve of similar design.

BECAUSE Davis has long specialized in automatic valves for every type of service, the problem of giving you exactly what you want in a solenoid operated valve is just a matter of knowing your requirements. Standard designs are available from stock to meet practically any condition. Special assemblies can be produced on short order.

Davis Solenoid Valves are in service in all branches of industry. They provide automatic control for the flow of any liquid or gas. Davis Patented "Packless" heads are unequalled for safety on volatile liquids. Davis Patented "Two-Step" valve action is available where fine control of quantity is desired. *Information on request.* DAVIS REGULATOR COMPANY, 2546 S. Washtenaw Ave., Chicago, Ill.

Write your own TICKET

DAVIS REGULATOR CO.
Chicago, Ill.

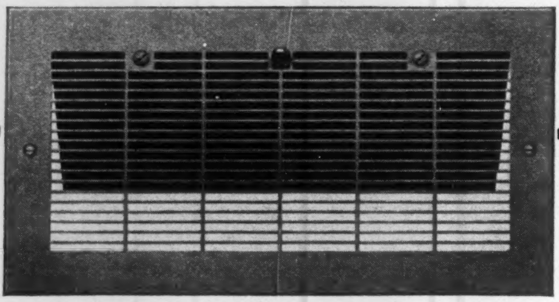
Please quote prices and send literature on Solenoid Valves to meet following requirements:

1. Size?........................ Quantity?........................
☐ Globe or ☐ Angle pattern? Type of valve?............
2. Fluid or gas to be handled?..............................
Temperature?..........Pressure, Max.?..........Min.?........
3. Nature of service?..
4. ☐ Open or ☐ Closed when solenoid is energized?
☐ Standard or ☐ Explosion proof solenoid box?
5. ☐ AC or ☐ DC current? Volts?............Cycles?............

Name..
Company..
Street..
Town...
State..............

***NOTICE**
Davis carries large stocks of all kinds of automatic valves for immediate shipment. Your order will get prompt attention.

NEW INDEPENDENT STAMPED STEEL AIR CONDITIONING REGISTERS and GRILLES



● Independent leads again with these new quality-built, good looking registers and grilles, made to sell at a low price. Write for samples and prices.

THE INDEPENDENT REGISTER CO.
3757 E. 93rd St. *** Cleveland, Ohio

Goodbye Rust and Red Water

When rust eats holes in a hot water heater, your customers must spend money for a new one. And when red water stains clothes or gets in the bath they blame you.

Why take such chances when you could eliminate rust and red water by installing

Patterson Copper-Lined or Everdur Hot Water Heaters

The Indestructo Heater has a heavy copper shell inside of the rugged steel shell, so there is nothing to rust. Patterson Indestructo Heaters in use over 25 years are still in fine condition.

· Patterson Heaters are also built with shells of pure copper, stainless steel, nickel clad steel and steel.

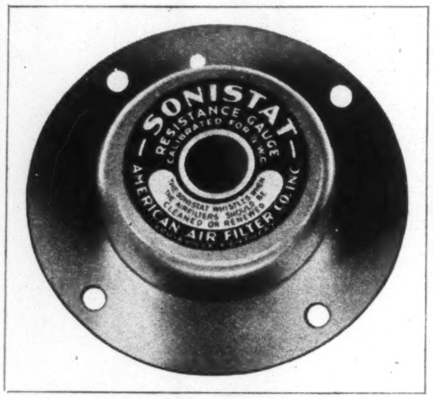
Write for catalog.

The Patterson-Kelley Co., Inc.
107 Warren St. East Stroudsburg, Pa.

for the second from ¾ to 2¼ in. Conductivity is stated as 0.33 Btu per hr per sq ft per F per in. thickness of the core.—Celotex Corp., 919 N. Michigan Ave., Chicago, Ill.

Warns of High Resistance in Air Filters

No. 1413—The "Sonistat," just announced, is a device arranged so that when the resistance to air flow of an air filter installation reaches a predetermined point, a low whistling sound is produced. This becomes more insistent as the resistance builds up. This device is for use with replacement type unit air filters to overcome their being neglected and the resistance building up and shutting down the air supply, as the manufacturer has found that complaints of inadequate cooling or heating are often due to a stopped up air filter.

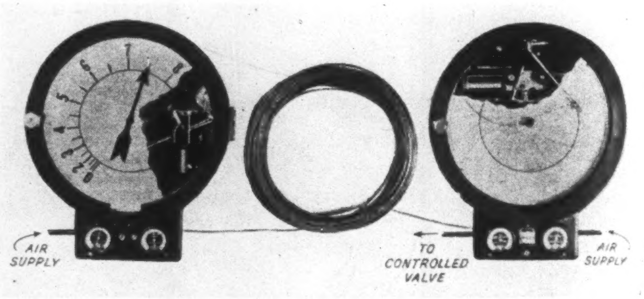


A notice on the gage gives the address of the source of supply where replacement filters can be secured.—American Air Filter Co., Inc., 107 Central Ave., Louisville, Ky.

Remote Measurement System Operates Pneumatically

No. 1414—A system for pneumatic remote transmission of measurement is a new process control development designed primarily for remote measurement in atmospheres containing explosive gases where electrical measurement would not be permissible. It consists essentially of a transmitting instrument at the point of operation and a receiver which may be an indicator or recorder located at the remote master control board.

The remote transmission unit is a simple balanced air pilot mechanically actuated. The receiver is either an indicating or recording pressure gage, calibrated in terms of the variables being measured.



According to the manufacturer, a definite pressure response for less than 1/10 per cent of full scale movement of the measuring element may be had. The receiver records less than 1/5 of 1 per cent change. Ambient temperature changes of 60 deg affect readings less than ¼ of 1 per cent, and the control will operate dependably at subzero temperatures. Air consumption is but 0.016 cu ft of free air per minute.—Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., 4534 Wayne Ave., Philadelphia, Pa.

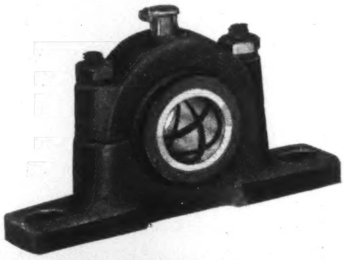
Offers Portable Room Coolers

No. 1415—Portable air conditioning units powered with heavy duty "Rollator" compressors are produced for private office or

NEW PRICE LIST *on*
RANDALL PILLOW BLOCKS
now ready

Improvement in Randall Pillow Blocks has always kept ahead of the rapid improvement in air conditioning equipment. Because of that fact and their remarkable quietness and long trouble-free service in the field, they have been accepted as standard equipment by the majority of air conditioning equipment manufacturers.

Let us quote on your yearly requirements for pillow blocks. Our new price list showing many reduced prices is now available. Write for a copy without obligation.



On light duty, normal furnace blower or air conditioning equipment, the Randall Standard Pillow Block should last a lifetime.

Randall **GRAPHITE PRODUCTS CORP.**
Dept. 210, 609 W. Lake St., Chicago, Ill.

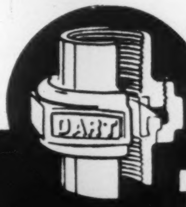
DARTS
ARE AN INSIDE JOB

There's no maybe about tightness when a Dart goes on the line . . . they're made right, inside.

But that's only the beginning. Re-install the same union again and again—and you're still sure of the same leak-proof, fool-proof service.

Darts have extra-wide, full-bearing bronze seats—GROUND to true ball joints that fit right, sit tight under repeated use. Extra-heavy bodies and nuts are of air-refined malleable iron, to resist pipe strains, thread distortion, repeated use.

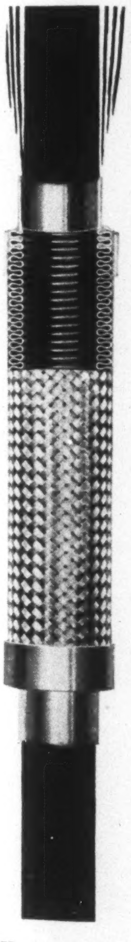
Only Darts have ALL these features. Say Darts when buying unions and pay less for longer service. Want to prove it? Write for one to try at our expense.



SALES AGENTS: THE FAIRBANKS COMPANY NEW YORK AND ALL BRANCHES

CANADIAN FACTORY: DART UNION COMPANY LTD. TORONTO CANADA

DART
UNIONS
E. M. DART MFG. CO., PROVIDENCE, R. I.



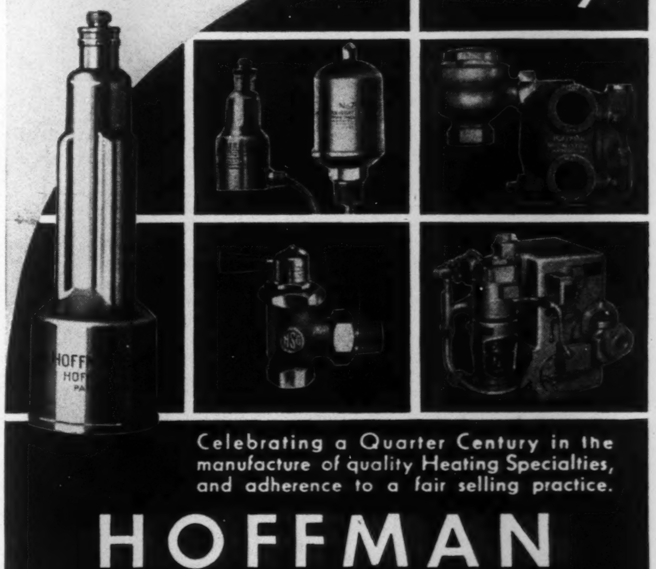
VIBRA-SORBERS

ABSORB VIBRATION, STOP NOISES IN COMPRESSOR PIPE LINES . . . ACT AS FLEXIBLE COUPLINGS FOR QUICK, TROUBLE-PROOF INSTALLATION . . . ALL SIZES.

Ask for
REX "VIBRA-SORBERS"

Made by
CHICAGO METAL HOSE CORPORATION
Maywood, Illinois

THIS IS OUR.. *Silver Anniversary*



Celebrating a Quarter Century in the manufacture of quality Heating Specialties, and adherence to a fair selling practice.

HOFFMAN
SPECIALTY CO., INC.
WATERBURY, CONN.

THERMOMETERS

THE POWERS
DIAL THERMOMETER
FAHRENHEIT
100
110
120
130
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90
80
70
60
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THE POWERS REGULATOR CO.
CHICAGO NEW YORK
POWERS

For
Indicating and Recording

Only a few of our indicating and recording thermometers are shown here. We also make a complete line of Thermometer-Regulators which Indicate and Control temperature or Record and Control temperature.

Write for Bulletin 255—THE POWERS REGULATOR CO., 2759 Greenview Ave., CHICAGO—231 E. 46th St., NEW YORK—Offices in 45 Cities—See your phone directory.

POWERS

ANSWERING THE INDUSTRY'S
Most Pressing Problem
WITH A *New Type of Craftsman*

● One of the serious obstacles to the continued growth of your industry is the ACUTE SHORTAGE OF REALLY COMPETENT MEN for sales and making and servicing air conditioning and refrigeration installations. Furthermore, the incompetence of many now in the ranks constantly results in the defeat of your best-laid sales program, killing public desire for your wares, creating customer dissatisfaction, and in *financial loss to you.*

Only by effective training of men both upon a qualitative and quantitative basis can your man-power problem be solved and the success of your efforts be insured.

With these requirements in mind, the Refrigeration and Air Conditioning Institute of Chicago has moulded its Training Program so that the student is so grounded in theory that he actually thinks in terms of refrigeration and air conditioning, and so that he learns the service and installation of equipment by intimate contact with all conventional types in our laboratory, the only one of its kind, so far as we know, under the actual supervision of factory engineers.

This Training Program is planned to DEVELOP THE UNTRAINED, to teach the PRACTICAL APPLICATION of theory to the COLLEGE TRAINED MAN, and to PERFECT THE PRESENT TECHNICIAN. Thus it makes the benefits of a new profession available for men in all walks of life, and it broadens the source of man-power for your Industry, and gives to the Industry a new type of craftsman.

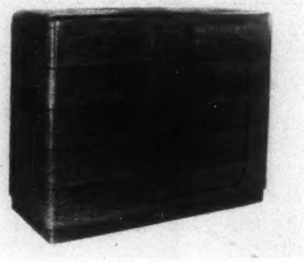
Mr. Employer, will you advise us of your requirements, so that we may be of service to you in solving your MAN-POWER PROBLEM?

More than 100 leading Manufacturers "officially" endorse and recommend this training program.

PRESIDENT

REFRIGERATION & AIR CONDITIONING
INSTITUTE
2130-2158 LAWRENCE AVENUE CHICAGO, ILL.

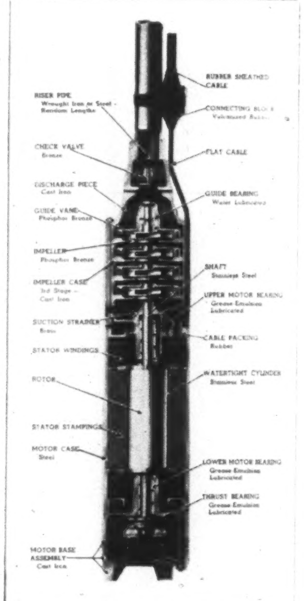
home air conditioning where a central system cannot be used. According to the manufacturer, these units deliver 200 cfm of cooled, dehumidified and cleaned air.



The maker states that this self-contained evaporative type unit has been developed to have a cooling capacity similar to water cooled self-contained units. Room temperature air is continually drawn into the unit by means of electric fans, through air filters and over cooling coils, then delivered at lower temperatures back into the room. Refrigerant circulated by the compressor through the cooling coils is boiled by the heat in the room air which is passed over the outside of the coil. The boiled refrigerant is then cooled by evaporation of water that is sprayed and pumped over the outside of the condensing coil. —Norge Heating & Conditioning Div., Borg-Warner Corp., 670 E. Woodbridge St., Detroit, Mich.

Deep Well Pumps Offered for Industrial Service

No. 1416—A submersible motor driven deep well centrifugal pump for industrial service, which is new to this country, but has seen service for several years abroad, was announced last month. Both the pump and the motor are in the well, and the advantages listed by the manufacturer are noiseless operation; easy installation; no pump house necessary; no line shaft, intermediate bearings, or stuffing box; lubricated pump bearings; and the lubricant cannot contaminate water. Particular applications are air conditioning or process cooling, and wherever water requirements are large, such as in laundries, beverage plants, and many process industries.


RISER PIPE
Wrought Iron or Steel - Random Lengths
CHECK VALVE
Bronze
DISCHARGE PIECE
Cast Iron
GUIDE VANE
Phosphor Bronze
IMPELLER
Phosphor Bronze
IMPELLER CASE
3rd Stage - Cast Iron
SUCTION STRAINER
Brass
STATOR WINDINGS
ROTOR
STATOR STAMPINGS
MOTOR CASE
Steel
MOTOR BASE ASSEMBLY
Cast Iron
RUBBER SHEATHED CABLE
CONNECTING BLOCK
Vulcanized Rubber
FLAT CABLE
GUIDE BEARING
Water Lubricated
SHAFT
Stainless Steel
UPPER MOTOR BEARING
Grease Emulsion Lubricated
CABLE PACKING
Rubber
WATERTIGHT CYLINDER
Stainless Steel
LOWER MOTOR BEARING
Grease Emulsion Lubricated
THRUST BEARING
Grease Emulsion Lubricated

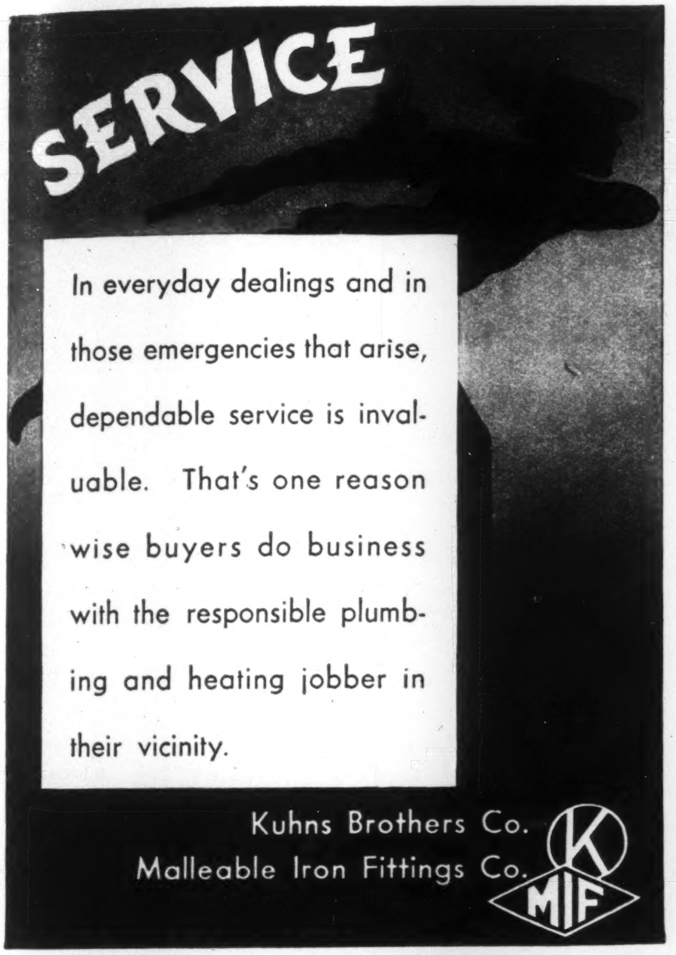
The unit comprises a vertical centrifugal pump direct connected to a submersible vertical motor, the assembly being suspended on the riser pipe, operating below water in the well. A waterproof cable conducts the current to the submersed motor, which can be furnished for either 60 or 50 cycle alternating current, single or three phase. The rotor operates in the water, but the stator is protected from the water by a patented stainless steel cylinder. Each motor bearing is separately enclosed in its own grease chamber.

The units are available in a wide range of sizes suitable for handling up to 1000 gpm.—American-Marsh Pumps, Inc., 60 Capital Ave., N. E., Battle Creek, Mich.

Duct Controllers Equalize Air Temperatures

No. 1417**—Illustrated is a duct controller designed for heating and air conditioning applications to maintain a balance between the return air and discharge air temperatures to prevent sudden changes in discharging first cold then hot blasts of air from a ventilating system.

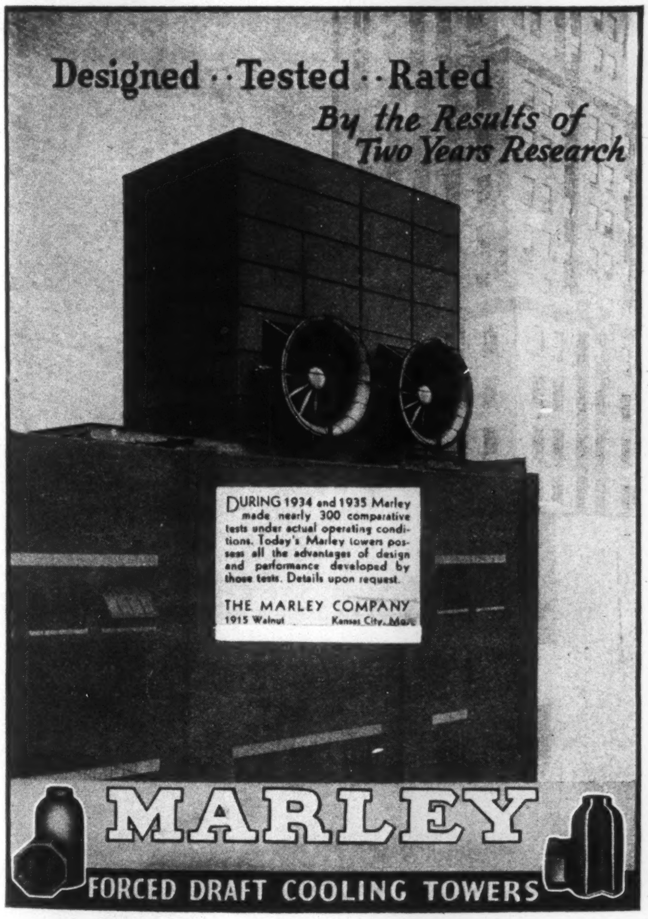
This is accomplished by the main control thermal element being affected by the return air temperature. This helps the discharge air thermal element (each compensating the other) to find the correct discharge air temperature and to maintain the de-



SERVICE

In everyday dealings and in those emergencies that arise, dependable service is invaluable. That's one reason wise buyers do business with the responsible plumbing and heating jobber in their vicinity.

Kuhns Brothers Co.
Malleable Iron Fittings Co.

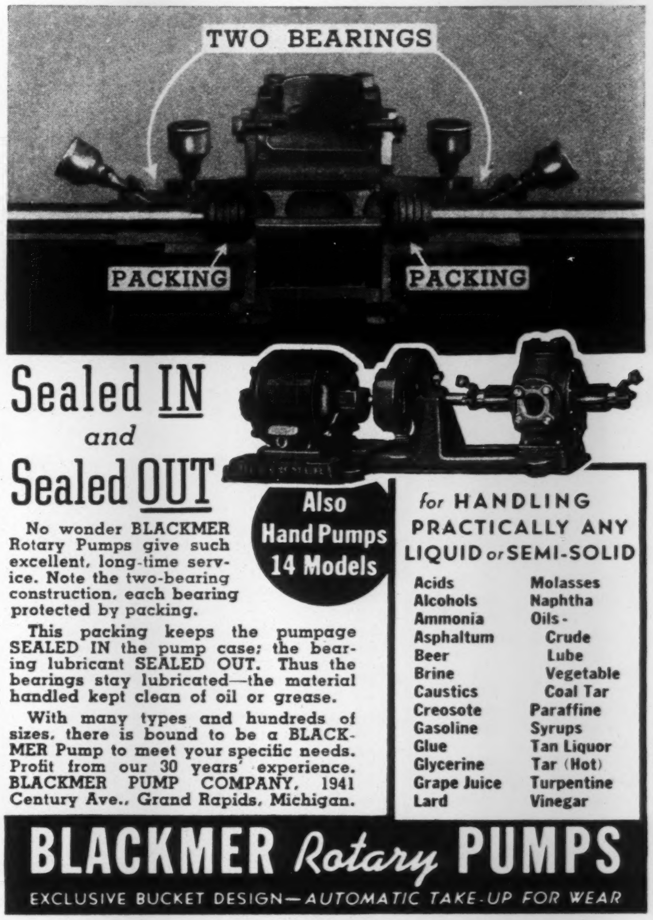


Designed · · Tested · · Rated
By the Results of Two Years Research

DURING 1934 and 1935 Marley made nearly 300 comparative tests under actual operating conditions. Today's Marley towers possess all the advantages of design and performance developed by those tests. Details upon request.

THE MARLEY COMPANY
1915 Walnut Kansas City, Mo.

MARLEY
FORCED DRAFT COOLING TOWERS



Sealed IN
and
Sealed OUT

No wonder BLACKMER Rotary Pumps give such excellent, long-time service. Note the two-bearing construction, each bearing protected by packing.

This packing keeps the pumpage SEALED IN the pump case; the bearing lubricant SEALED OUT. Thus the bearings stay lubricated—the material handled kept clean of oil or grease.

With many types and hundreds of sizes, there is bound to be a BLACKMER Pump to meet your specific needs. Profit from our 30 years' experience. BLACKMER PUMP COMPANY, 1941 Century Ave., Grand Rapids, Michigan.

Also
Hand Pumps
14 Models

for HANDLING
PRACTICALLY ANY
LIQUID *or* SEMI-SOLID

Acids
Alcohols
Ammonia
Asphaltum
Beer
Brine
Caustics
Creosote
Gasoline
Glue
Glycerine
Grape Juice
Lard
Molasses
Naphtha
Oils -
  Crude
  Lube
  Vegetable
  Coal Tar
Paraffine
Syrups
Tan Liquor
Tar (Hot)
Turpentine
Vinegar

BLACKMER *Rotary* PUMPS
EXCLUSIVE BUCKET DESIGN—*AUTOMATIC TAKE-UP FOR WEAR*

ALL-CAST FIN SECTION
Eliminates
ELECTROLYSIS *and* CORROSION

Note how each heating fin section is made of cast aluminum alloy, cast in one piece and bonded to high-test alloy iron steam chamber. These sections placed together make up the heating element in GRID Unit Heaters—an open design between fins that makes it possible to keep clean under all atmospheric conditions.

In it there are no expanded, soldered, or rolled joints, and no dissimilar metals in contact with steam to produce electrolytic action. Complete details upon request.

THE UNIT HEATER & COOLER CO.
Wausau, Wisconsin
Offices in all principal cities

GRID
UNIT HEATER

SOONER OR LATER THEY ALL COME TO IT!

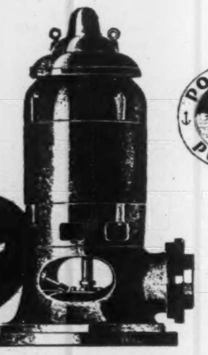
Watch the experienced pump user specify Pomonas, and repeat. One large municipal installation operates 22 Pomona Pumps. Many other multiple installations are on record. Sooner or later they all come to it by seeing what Pomona owners get—in steadiness of performance, high efficiency which means low power costs and low maintenance expense (often no repairs in ten years of service).

Pomona builds Pumps . . . Deep Well Turbine Pumps in the full range . . . a size for every service wherever water is available. Two Pomona Pumps recently installed in a city water plant are believed to be the largest in the world. Put your pump problems up to an organization that knows pumps.

POMONA PUMP CO.

Manufacturing Plants: Pomona, California - St. Louis, Missouri
Branch Offices: New York, Chicago, Los Angeles, San Francisco

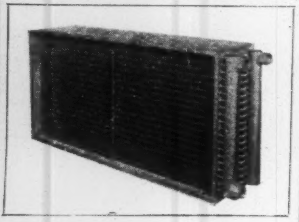
"The Most Copied Pump in America"



POMONA Oceans of Water PUMPS

Pomona TURBINE PUMPS

McQUAY For Every Phase of AIR CONDITIONING



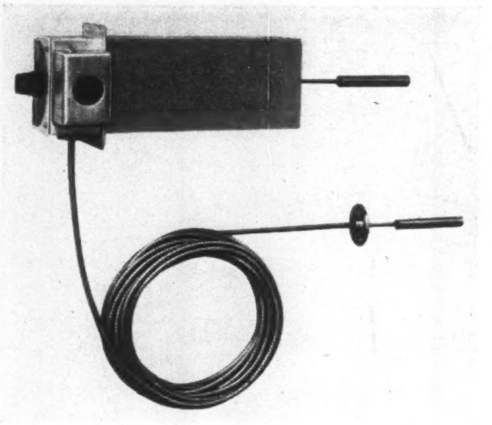
EFFICIENCY
for all phases of
AIR CONDITIONING APPLICATIONS

DIRECT EXPANSION COOLING
★
WATER COOLING AND HEATING
★
STEAM HEATING

Built in a wide range of standard sizes and capacities, McQuay Coils form a vital part of any Air Conditioning installation. Easy to select and install. Durable, Compact, and Efficient.

McQuay engineers can ideally serve your exacting requirements. Write today for descriptive bulletin.

McQUAY, INC.
MINNEAPOLIS, MINNESOTA.

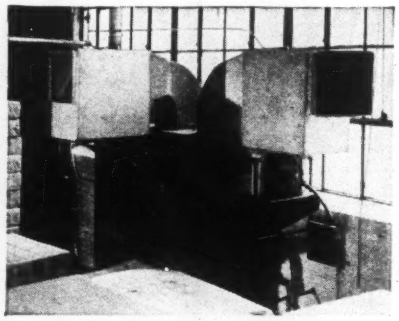


sired return air temperatures from its two control locations.

The instrument incorporates an exclusive operating feature of a constant and variable principle of transmitting temperature changes through the use of a bourdon tube. This tube is incorporated in the main control end and adjusts itself to the constant air temperature changes. The thermal control element extending from the bourdon tube head transmits any small change of temperature immediately to the bourdon tube, causing the control instrument to respond to small temperature variations to operate automatic valves, motors, dampers, etc. Automatic Temperature Control, Inc., 101 Park Ave., New York, N. Y.

Humidifier for Industrial and Other Service

No. 1418—The "humidity box" announced recently is a high efficiency spray or fog chamber provided with suitable water filter and nozzle, air filter eliminator or baffle, and drain fitting. Its particular application is to introduce moisture into spaces warmed by unit heaters, and the illustration shows two of the boxes on the outlets of a blower type unit heater. They can also be used with propeller type units or in ducts.



Where less than 30 lb per sq in. water pressure is available, an electric vaporizer may be used for atomization. The unit is available with or without fans.—Air Conditioning Supply Co., 1893 E. 55th St., Cleveland, Ohio.

Book Reviews

New Book on Air Conditioning

["Air Conditioning in Summer and Winter", by Richard E. Holmes, Design Engineer, Westinghouse Electric & Mfg. Co. 1st ed. 1938. 296 + xii pp., 6 x 9 in., clothbound. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Price, $3.00.]

The author assumes that the reader has no previous knowledge of air conditioning and aims to give, in this new work, engineers and students with secondary school technical education a presentation of the science. The discussion consists of the rewritten and expanded lessons given by the author at the Westinghouse plant for two years to students employed in or preparing for the air conditioning industry.

While mainly descriptive in character, a number of problems are given, including in the latter chapters step-by-step examples

HIGH SPEED *Shears*

TODAY'S FASTEST SHEARS FOR PRODUCTION OF IRREGULAR SHAPES FROM SHEET METAL

No further finishing required, and absolutely accurate — easily operated. Equipment furnished for cutting outside and inside diameters of rings without any machine change or adjustment.

Metal is sheared and not punched . . . unobstructed cutting vision . . . no starting hole required. No special cutters, pilots, templates, or strippers are needed . . . long life sheer blades. Write for complete information.

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Manufacturers of shears since 1915

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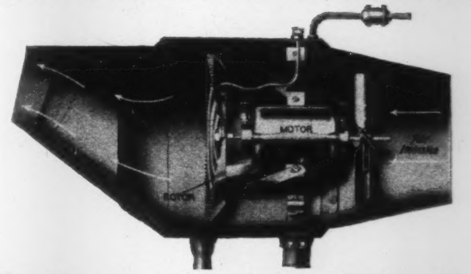
It fits like a Glove!

FOR YOUR SPECIFIC MOTOR PROBLEM

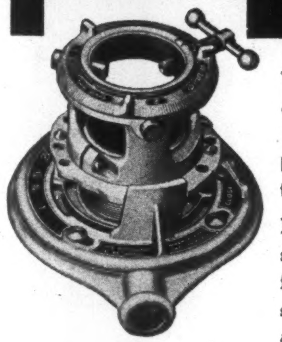
HOLTZER-CABOT
Custom-Built MOTORS



~ Write and Let Us Help You ~

The HOLTZER·CABOT
ELECTRIC COMPANY
BOSTON ~ ~ ~ ~ ~ MASS.
CHICAGO · NEW YORK · PHILADELPHIA ·

This RIDGID No. 65-R Threader
Saves you time and bother
Changing Dies . . .



You've got more important things to do than changing dies to thread 1″, 1¼″, 1½″ and 2″ pipe. And this RIDGID No. 65R saves you the trouble — all pipe, all threads.

For in this remarkable tool, the same set of dies threads all 4 sizes perfectly. Simply move setting post to size you want. No extra dies to lug around, to worry about losing.

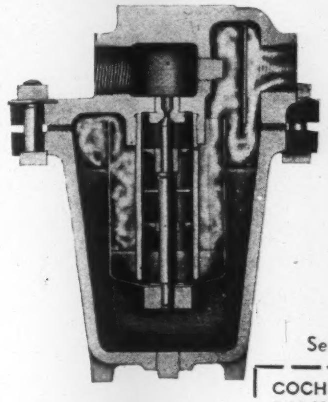
Slick work-holder, too — sets quickly to pipe size, tightens with one screw.

A strong, beautifully balanced tool pleasing thousands by its fast clean work. Try it — you like the "feel" of it at once. Buy from your Jobber.

THE RIDGE TOOL CO., ELYRIA, O.
Makers of the Famous RIDGID *Wrench*

RIDGID PIPE TOOLS

The New **COCHRANE STEAM TRAP**
STRAIGHT-LINE • BUCKET TYPE



For condensate drainage of steam lines, coils, evaporators, jackets, rolls, mixers, stills, etc., at pressures up to 150 lbs.

Only two moving parts, bucket and valve. Quick, positive action makes wire drawing impossible. Positive water seal prevents blowing steam. Straight-line installation lessens pipe fittings required and makes inspection easy without disturbing connections.

Send for Prices — Use Coupon

Cochrane Trap Ratings are scientifically determined. Publication No. 2663 tells how to select proper size.

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Please send a copy of Publication No. 2663, TRAPS, with information and prices.
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OIL—STEAM
The K-10 Lever-action Valve has 6 times the power of straight magnetic valves. Controls oils as heavy as No. 6 or steam at high pressure.

WATER
K-20 two-wire, current-failure, quiet solenoid valve closes with the flow. High seating pressure—tight closing.

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Like all Generals, the K-3B Magnetic Gas Valve is packless in construction, quiet in operation. Greatest existing size range—from 3/8" to 6".

REFRIGERANTS
K-15 pilot-operated valves fully powered for instant opening. Controls Freon, SO2, Methyl Chlorides, Ammonia.

New 1938 CATALOG
Complete engineering data on entire General line.

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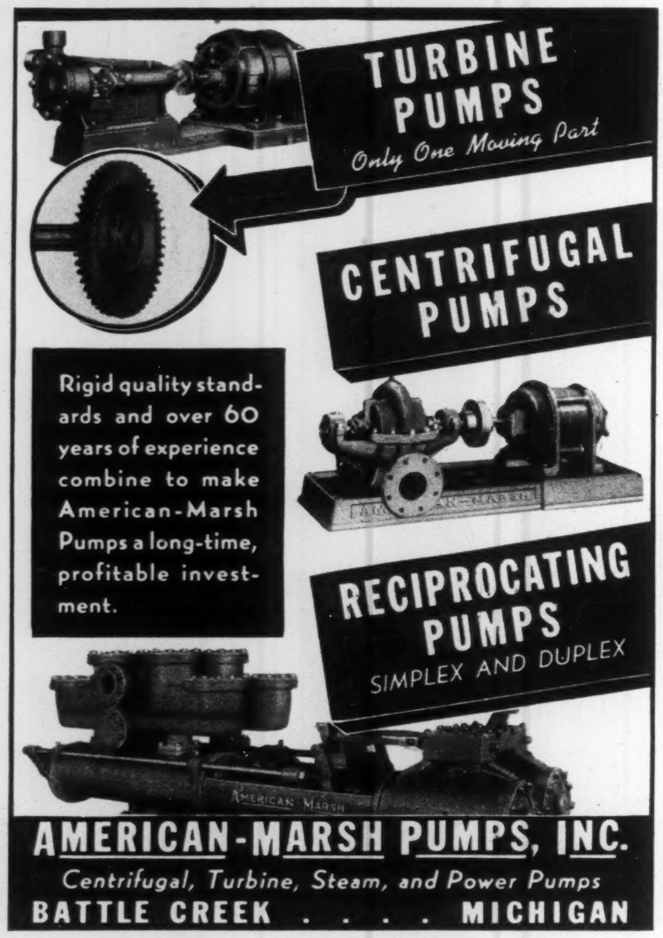
ORIGINATORS OF THE QUIET A. C. SOLENOID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Only One Moving Part

CENTRIFUGAL PUMPS

Rigid quality standards and over 60 years of experience combine to make American-Marsh Pumps a long-time, profitable investment.

RECIPROCATING PUMPS
SIMPLEX AND DUPLEX

AMERICAN-MARSH PUMPS, INC.
Centrifugal, Turbine, Steam, and Power Pumps
BATTLE CREEK . . . . MICHIGAN

of the application of both winter and summer air conditioning equipment. In these examples, reference is made to the detailed treatment of the various items given in preceding chapters and to the tables and other data included from the publications of the A.S.H.V.E. and from manufacturers' catalogs.

The author bases calculation of heat losses for determining the required capacity of a heating plant upon the lowest outdoor temperature ever reported, whereas the A.S.H.V.E. "Guide" states that the outside temperature to be assumed in the design of any heating system is ordinarily not more than 15 deg above the lowest reported temperature as reported by the weather bureau during the preceding 10 years.

Chapters are given on the nature of the atmosphere, psychrometry, requirements for comfort, air conditioning systems, the winter air conditioning load (air infiltration heat loss, heat transmission loss and the total heating and dehumidifying load), heaters, humidifiers, air filters, application of winter air conditioning equipment, refrigeration principles, refrigerants, refrigeration systems, summer air conditioning load, dehumidifiers, condensing equipment, modern refrigerating equipment, application of summer air conditioning equipment, and temperature and humidity controls.

Conventions and Expositions

Western Metal Exposition and Congress: March 21-25, Pan-Pacific Auditorium, Los Angeles, Calif. Auspices, American Society for Metals, W. H. Eisenman, Secretary, 7016 Euclid Ave., Cleveland, Ohio.

Midwest Power Conference: April 13-15, La Salle Hotel, Chicago, Ill. Under sponsorship of Armour Institute of Technology with the cooperation of six midwestern state universities. Director, L. E. Grinter, Armour Institute of Technology, Chicago, Ill.

American Foundrymen's Association: Annual convention, May 16-19, Public Auditorium, Cleveland, Ohio. Headquarters Office, 222 W. Adams St., Chicago, Ill.

Heating, Piping and Air Conditioning Contractors National Association: 1938 convention, May 31-June 2, Boston, Mass. Chairman of Convention Committee, Frank E. Kise. Headquarters Office, 1250 Sixth Ave., New York, N. Y.

American Society for Testing Materials: Annual meeting, June 27-July 1, Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary-Treasurer, C. L. Warwick, 260 S. Broad St., Philadelphia, Pa.

National Industrial Advertisers Association: Annual conference, September 21-23, Cleveland, Ohio. Committee Chairman, Stanley Knisely, Advertising Manager, Republic Steel Corp., Republic Bldg., Cleveland, Ohio.

American Public Health Association: Annual meeting, October 25-28, Kansas City, Mo. Headquarters Office, 50 W. 50th St., New York, N. Y.

Recent Trade Literature

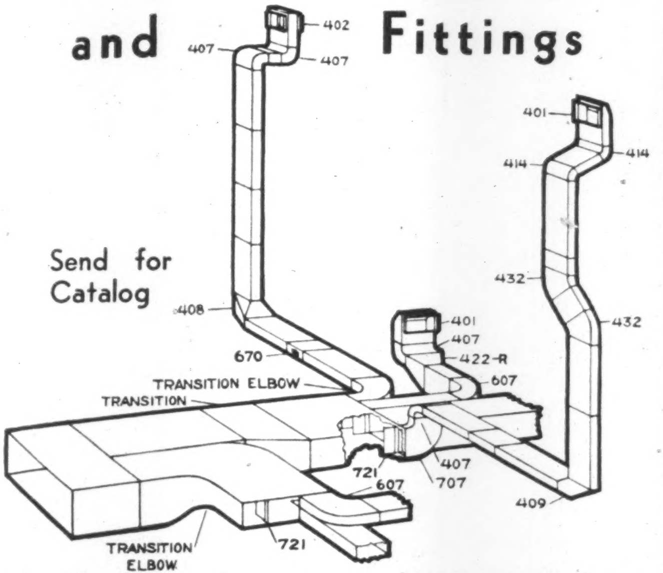
For your convenience in obtaining copies of these bulletins, see coupon on page 135. If you write direct to the manufacturer, be sure to describe carefully what literature you want, as the reference numbers given are for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 2649. BLOW-OFF VALVES: Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn. 4 p. bulletin describing features of new blow-off valve which has "Blo-Deflector" protecting lip to prevent wear and leakage. Construction is shown in detail and ratings and dimensions are given.

No. 2650. BOILER PROTECTION: Warren Webster & Co., 17th and Federal Sts., Camden, N. J. 8 p. catalog show-

MONCRIEF

Air Conditioning Pipe and Fittings



Send for Catalog

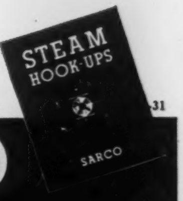
Everything for complete summer and winter air conditioning installations. Made with special Moncrief lock joints. The product of 39 years experience in the manufacture of pipe and fittings. Send for Catalog.

The Henry Furnace & Foundry Co.
3480 E. 49th St. Cleveland, Ohio

THE SARCO WATER BLENDER

Blended water at correct temperatures from any main line at no added expense! Saves on hot water expense in washrooms, showers and process work. Increases effective capacity of heaters already installed. It's a thermostatic mixer—needs no reducing valves. Set it once, and it delivers hot water at the predetermined temperature, regardless of fluctuations in hot and cold water supply or pressure. Also used for cooling coils or jackets. Ask for Catalog No. 140.

ASK FOR THIS NEW DATA BOOK
—On your business letter-head. Shows how to hook up all types of heating, air conditioning and process equipment with suitable traps and control.



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SARCO

THERMOSTATIC, FLOAT AND BUCKET TRAPS, REGULATORS AND HEATING SPECIALTIES
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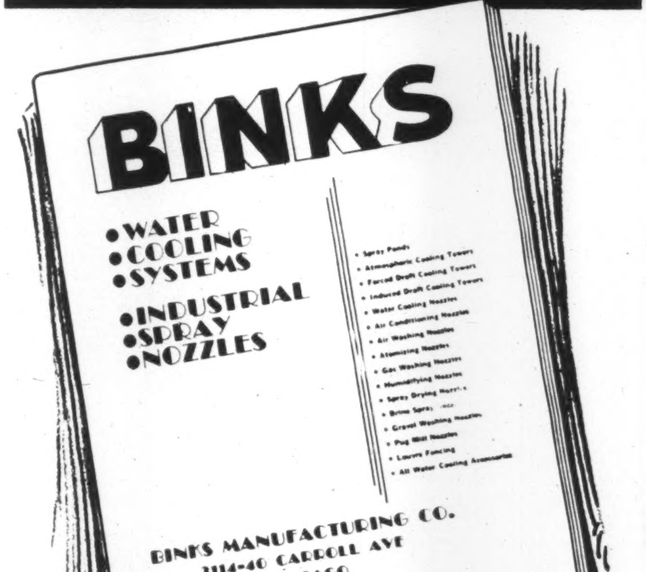
ENTIRELY *NEW* CATALOG



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3114-40 CARROLL AVE
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on Industrial Spray Nozzles—Atmospheric Spray Cooling Towers—Induced Draft Cooling Towers and Forced Draft Cooling Towers.

BINKS MANUFACTURING COMPANY
3114-40 CARROLL AVE. CHICAGO

"Hard-to-heat" places *demand* electric heat

Sometimes there is no other way to heat certain places in a plant except with "wired heat." In large numbers of these cases the need is met by the proper type of

CHROMALOX
ELECTRIC AIR HEATER

Available in all required capacities, and in both convection type and blower type, and portable or for permanent installation. Crane cabs, locomotive cabs, isolated spots such as watchmen's cabins, pump houses, etc., are most easily and economically heated with Chromalox heaters.

In heating plant additions, too, Chromalox heaters often avoid the need for expensive increase in boiler capacity. And for overtime heat they not only reduce boiler room costs, but also provide the convenience of service at any time, weekday or Sunday, day or night.

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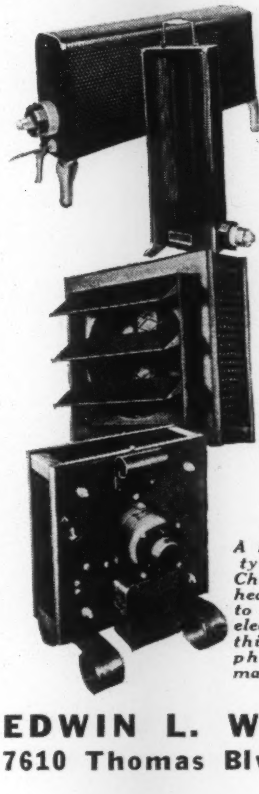

A few of the many types in which Chromalox electric heaters are stocked—to supply economical electric heat for anything from a telephone booth to a manufacturing floor.

In Chromalox heaters you get the seasoned experience of engineers whose function is to solve problems of electrically heating anything industrial. Bring them your problem. Catalog on request.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh, Pa.

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AIR CONDITIONING
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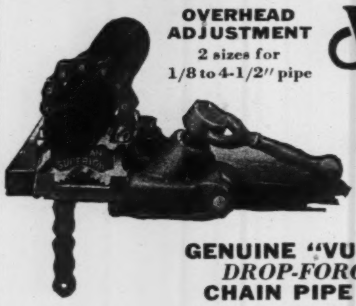

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ing how this company's boiler protector gives protection against damage and annoyance from accidental low water in low pressure heating boilers. Models for hand fired boilers, and with electrical cut-out switch for electrical and stoker fired boilers are included, and their construction is illustrated and described. Capacities, application data, and information for ordering are presented.

No. 2651. BOILER REGULATION: Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., 4534 Wayne Ave., Philadelphia, Pa. 24 p. catalog on automatic boiler regulation system for boilers under 1000 hp operating at pressures up to 300 lb, including steam damper regulator and over-fire control, manufactured by National Regulator Co., also a division of Minneapolis-Honeywell Regulator Co. Items described include steam damper regulators, over-fire controls, control valves, and accessories.

No. 2652. CONDUIT: American District Steam Co., North Tonawanda, N. Y. Revised 8 p. bulletin on "Adsco-Bannon" tile conduit and "Adsco-Corning" filler insulation for underground steam or hot water lines, including illustrations of the products, details of construction, and their applications.

No. 2653. DUCT CONSTRUCTION: Metal Lath Manufacturers Association, 208 S. LaSalle St., Chicago, Ill. Issue of "Metal Lath News" dated January, 1938, including technical data sheets showing construction details of ventilating ducts, (1) contact ducts under existing lath and plaster ceilings on wood joists, and (2) suspended ducts under existing exposed concrete slab floors or heavy timber flooring. Scale details, construction photos, design factors, and other information are given.

No. 2654. DUST: W. W. Sly Mfg. Co., 4700 Train Ave., Cleveland, Ohio. Two booklets by F. A. Ebeling, one on the dust problem in business, and the other on dust storms, the latter discussing the industrial dust problem.

No. 2655. FANS: Emerson Electric Mfg. Co., 1847 Washington Ave., St. Louis, Mo. 26 p. 1938 catalog covering desk fans, stand fans, ceiling fans, air circulators, and ventilating and exhaust fans, including accessory equipment.

No. 2656. FLEXIBLE METAL TUBING: Eclipse Aviation Corp., 545 N. Arlington Ave., East Orange, N. J. 4 p. reprint on seamless flexible metal tubing, giving information on types, sizes, and fittings available, and how to install tubes to avoid failure.

No. 2657. GAGES: Ashton Valve Co., 161 First St., Cambridge, Mass. 32 p. sectional catalog covering industrial gages of many types, illustrating and describing them and giving detailed tabular data. Also illustrated and described are dead weight gage testers, gage test pumps, portable boiler test pump outfits, pulsation retard devices, cocks and valves, etc.

No. 2658. HEATERS: Howard Iron Works & Alberger Heater Co., 287 Chicago St., Buffalo, N. Y. 36 p. catalog of instantaneous heaters, feed water heaters, storage heaters, heat exchangers, vapor condensers, surface condensers, heating system converters, and other equipment. In addition to information on this equipment, considerable engineering data are included and an alignment chart for determining correct sizes for steam, condensate and water pipe lines is presented.

No. 2659. INDUSTRIAL COMPRESSORS: Ingersoll-Rand, 11 Broadway, New York, N. Y. 4 p. bulletin on small industrial compressors and vacuum pumps, ranging in size from ¼ to 15 hp. Complete rating tables on more than 50 models are presented.

No. 2660. INSULATION: Hinde & Dauch Paper Co., Sandusky, Ohio. 12 p. booklet on "Ideal" air cell insulation, discussing its advantages and the principles of insulation, and showing applications.

No. 2661. PISTON RINGS: Auto-Diesel Piston Ring Co., 1440 E. 32nd St., Cleveland, Ohio. Data sheets on various types

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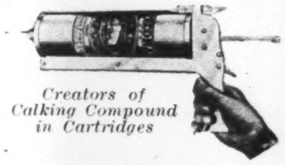

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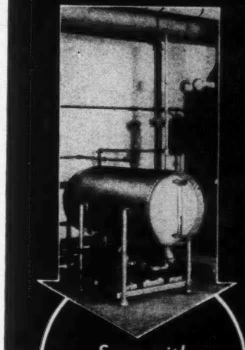

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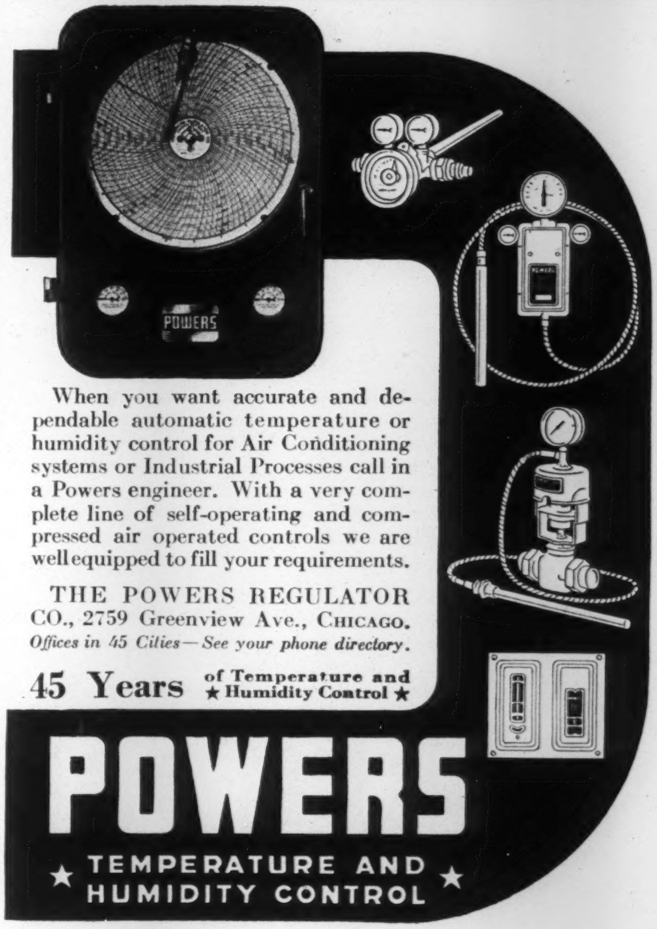

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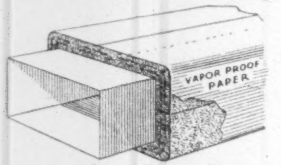

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of rings and their applications, including compression rings, scraper compression rings, two piece compression, three piece compression, oil wiper, motor seal, and superdiesel types. Stock list tables are presented.

No. 2662. REFRIGERANTS: E. I. du Pont de Nemours & Co., R. & H. Chemicals Dept., Wilmington, Del. 6 p. issue of "Artic Service News," including the fourth installment of an article on methyl chloride, giving technical data on its properties.

No. 2663. REFRIGERATING UNITS: Frick Co., Waynesboro, Pa. 12 p. bulletin on combined ammonia refrigerating units, describing their features and showing numerous applications, including air conditioning. A brief explanation of the principles of refrigeration is given and specifications for the units are presented.

No. 2664. REGISTERS AND GRILLES: Gillian Mfg. Co., 650 E. Troy Ave., Ferndale, Mich. Looseleaf bulletin describing various styles of "G-M" air conditioning registers and intakes, including perforated and fin type designs. Price lists are included.

No. 2665. RELIEF VALVES: Cochrane Corp., 3161 N. 17th St., Philadelphia, Pa. 16 p. bulletin on multiport relief valves, discussing applications, illustrating various installations, describing advantages, presenting information on selection, and with tables of list prices and weights.

No. 2666. ROOM COOLERS: Merchant & Evans Co., 2035 Washington Ave., Philadelphia, Pa. Specification sheets on compressor data for air conditioning room coolers with capacities from 6000 to 42,000 Btu per hr.

No. 2667. RUBBER PIPE JOINTS: United States Stoneware Co., 60 E. 42nd St., New York, N. Y. 16 p. bulletin describing "Flexlock" rubber joints for acid-proof piping, describing their seven principal advantages, showing in detail how to make a joint, and giving data on the various types.

No. 2668. SHEARS AND PRESSES: Niagara Machine & Tool Wks., 637-697 Northland Ave., Buffalo, N. Y. 64 p. booklet on squaring shears, rotary shears, presses and punches for shearing, blanking, drawing and forming sheet and plate metal.

No. 2669. STEAM ENGINES: Troy Engine & Machine Co., Troy, Pa. 12 p. bulletin entitled "½ Cent per Kilowatthour Power Cost," describing how 43 concerns and institutions in 29 different industries cut power costs for driving 19 different types of auxiliaries to an average of ½ cent per kwhr. Detailed information is given on many installations and a summary table presents complete data.

No. 2670. SUMP PUMPS: Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill. 8 p. catalog on floatless automatic electric sump pumps, including description of the electrical control system, hook-up diagrams, and other data.

No. 2671. TANKS: Haveg Corp., Newark, Del. 8 p. bulletin giving complete technical data on standardized cylindrical tanks for particular use where chemical corrosion enters into manufacturing processes. Tables of design data, chemical resistance, cover installations, nipple and insert type openings, manholes, etc., are given with the discussion of covers and outlets.

No. 2672. THERMOSTATS: Perfex Corp. (Controls Div.), 415 W. Oklahoma Pl., Milwaukee, Wis. Issue No. 4 of "Perfex Twin Contact" devoted entirely to a new clock thermostat, its advantages, specifications, and uses.

No. 2673. UNIT HEATERS: Airtherm Mfg. Co., 1474 S. Vandeventer Ave., St. Louis, Mo. 8 p. bulletin on the "Airblanket" unit heater designed to provide complete control of convection air currents without the use of louvers, deflectors or ducts. This method of heating is described, various case studies are reported, and the units are illustrated.

No. 2674. VENTILATORS: Swartwout Co., 18511 Euclid Ave., Cleveland, Ohio. 20 p. catalog on rotary ball bearing ventilators for industrial and commercial buildings, describing features and advantages in detail, showing construction, and giving tables and information on estimating capacities. Accessory equipment is described and typical installations are pictured.

No. 2675. WATER HEATERS AND HEAT EXCHANGERS: Patterson-Kelley Co., Inc., East Stroudsburg, Pa. 16 p. technical data bulletin on instantaneous water heaters and heat exchangers, illustrating and describing construction, giving tables of dimensions, capacities and weights, and diagramming installations for instantaneous hot water service heaters, two pass hot water service heaters for gravity circulation, preheaters or condensate coolers, combined preheaters and hot water heaters, converters for gravity and forced circulation heating systems, and swimming pool heaters.

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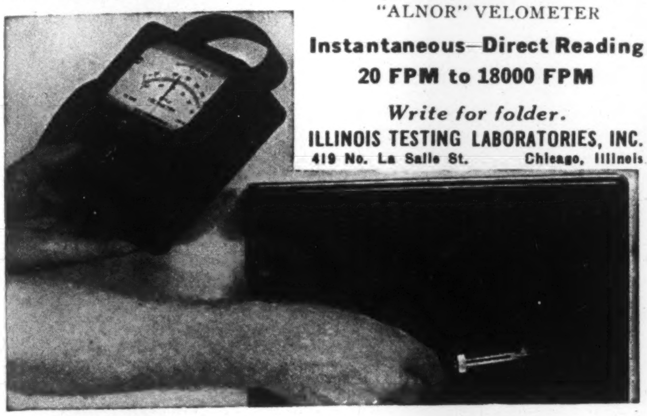

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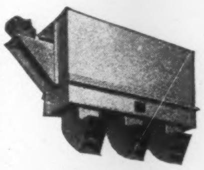

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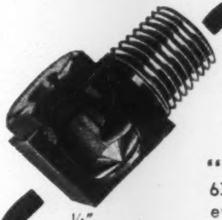

¼"
Fig. 629

AIR CONDITIONING SPRAYS

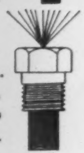

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Fig. H-261

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With these requirements in mind, the Refrigeration and Air Conditioning Institute, of Chicago, has moulded its Training Program so that the student is so grounded in theory that he actually thinks in terms of refrigeration and air conditioning, and so that he learns the service and installation of equipment by intimate contact with all conventional types in our laboratory, the only one of its kind, so far as we know, under the actual supervision of factory engineers.

This Training Program is planned to DEVELOP THE UNTRAINED, to teach the PRACTICAL APPLICATION of theory to the COLLEGE TRAINED MAN, and to PERFECT THE PRESENT TECHNICIAN. Thus it makes the benefits of a new profession available for men in all walks of life, and it broadens the source of man-power for your Industry, and gives to the Industry a new type of craftsman.

The individual qualifications of our graduates are recorded in a form which enables you to select at a glance the man best suited to your needs.

Mr. Employer, will you advise us of your requirements, so that we may be of service to you in solving your MAN-POWER PROBLEM?

MORE THAN
100
LEADING
MANUFACTURERS
"OFFICIALLY" ENDORSE
AND RECOMMEND
THIS TRAINING!

• • •

If you do not have a copy of the Institute's "Report to the Industry"—a 200 page cloth bound book with 17 big photographs—please ask for it on your letterhead.

PRESIDENT

REFRIGERATION & AIR CONDITIONING INSTITUTE
2130-2158 LAWRENCE AVENUE . . . . . . CHICAGO, ILL.

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Combination No. 1

Here is just one of the many practical combinations that are possible with the AirMaster "Build Up" Selection Method.

Grille illustrated has individually adjustable streamlined bars spaced on half-inch centers. Duotrol Damper with louvres at one-inch spacings permits any desired volume and directional setting.

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Most flexible and complete control of air distribution ever developed.

Return grille assemblies to match every combination.

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WATERLOO REGISTER CO.

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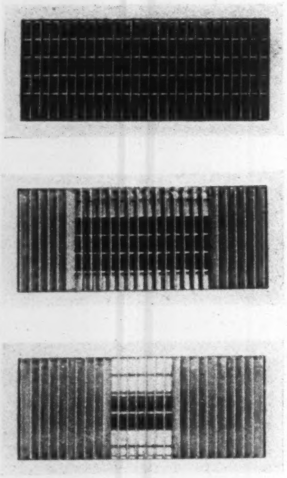


Booklets, Reports and Papers

Reports Experience With Air Conditioned Hospital

Dr. Albert G. Young, medical director of the air conditioned Corey Hill hospital, reported the first year's experience at a meeting of the Air Conditioning Bureau of Boston late last fall. The details of the Corey Hill system were fully described by A. J. Lawless in the March, 1937, H. P. & A. C.

The following is from Dr. Young's report:

About one year ago the Corey Hill hospital was opened as the first completely air conditioned hospital in the country. The specifications called for a relative humidity of 30 per cent at all times, and temperature control that would maintain 75 F in subzero weather and not more than 80 F when the outside temperature was 95 to 100 F.

These were exacting requirements and some engineers were skeptical of the possibility of maintaining such a low relative humidity in the Boston area. It was finally decided that the system would consist of a combined cooling and absorption system, the cooling being done by refrigeration; lithium chloride was chosen as the absorption medium.

Each room was supplied with air through an ejector type unit. Because of odors and the psychological hazard, it was decided not to recirculate any air. For the sake of temperature control, a steam coil was included in each of the ejector units so that the patients could add heat to the room if desirable. The hospital was divided into three zones for the duct system. The operating suite constituted one zone, because it is necessary to have a higher temperature and humidity there than in the rest of the hospital. The wings were divided into separate zones so that the temperature of the area could be adjusted, depending upon the amount of heat due to direct sunlight.

The winter of 1936-37 was a warm, damp winter which demanded considerable dehumidifying. It was interesting to note that with the doors and windows double sashed, patients had very little conception of what outside weather conditions were. However, the greatest test of the equipment took place during the summer of 1937, since we had a very warm, humid summer. During this time, in spite of the fact that we had temperatures as high as 99 F, with relative humidity of 55 per cent, and temperatures a few days later as low as 62 F with relative humidity of 94 per cent, the recording thermometer in the hospital showed that the temperature of the rooms did not exceed 78 F and the relative humidity did not exceed 33 per cent. In August we had recorded temperatures of 98 F with a relative humidity of 84 per cent at 7:30 a. m. which dropped to 44 per cent at noon and then rose again to 72 per cent at 7:30 p. m.

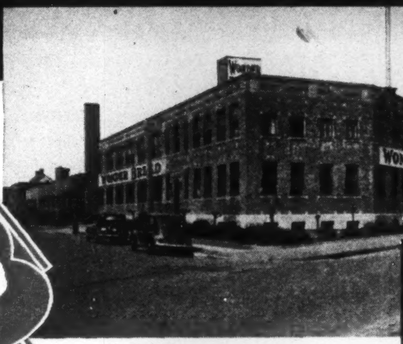
Effect of Air Conditions on Patients

It is only by study of the meteorological charts that one can fully appreciate the extreme changes which take place within a period of a few hours, and this is all-important to patients. It is generally known that the ideal humidity for most individuals is between 25 and 35 per cent. In going below this there is no detrimental effect, but we do not know of any value attained by a lower humidity. When we go above 35 per cent relative humidity, we do know that it places a greater load on the heart and circulation, as well as the respiration. To the normal individual this is hardly noticeable until the humidity reaches 65 per cent or more, but the patient who is suffering from a circulatory disease will show a decided change by the time the humidity has reached 45 per cent and will also react adversely to increase in temperature above 80 F.

From the standpoint of the very ill patient, constancy of temperature and humidity is very important. Sudden changes are comparable to moving the patient about from one bed to an-

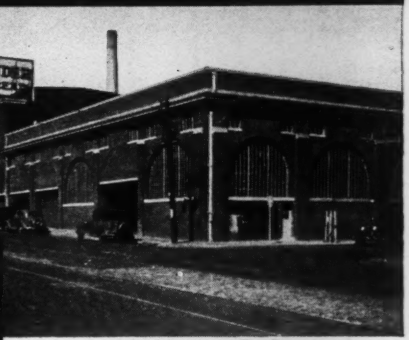
15 DETROIT STOKERS *for* CONTINENTAL BAKING CO. PLANTS

HOSTESS
CAKE


WONDER BREAD
WONDER BREAD

Bridgeport, Conn.
(1934)

THE NEW
WONDER
IT'S SLO-BAKED



Washington, D. C.
(1932)

IT'S SLO-BAKED
WONDER
BREAD

NEW HOME
Hostess Cake

Detroit, Mich.
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WONDER BREAD

Akron, Ohio
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Detroit Stokers in Wonder Bread and Hostess Cake Plants of the Continental Baking Company

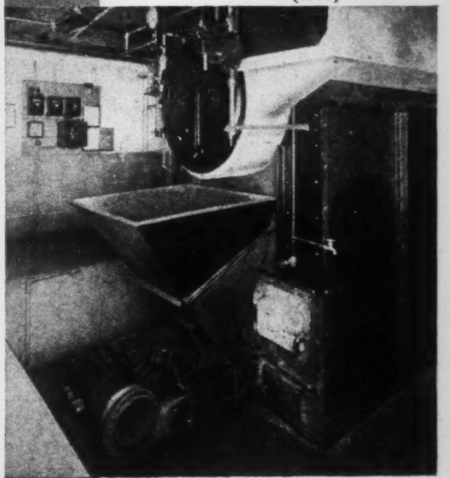
A Remarkable Record of Satisfaction

Detroit Stokers Have Been Installed In the Following Continental Plants

1929 Detroit, Mich.
1931 New Haven, Conn.
1931 Boston, Mass.
1932 Washington, D. C.
1932 Cleveland, Ohio
1934 Gary, Ind.
1934 Brooklyn, N. Y.
1934 Indianapolis, Ind.
1934 Bridgeport, Conn.
1935 Dayton, Ohio
1935 Akron, Ohio
1936 Holyoke, Mass.
1936 Springfield, Mass.

Detroit Stokers have provided "Continental" with the desired performance–economical–uniform–smokeless boiler operation.

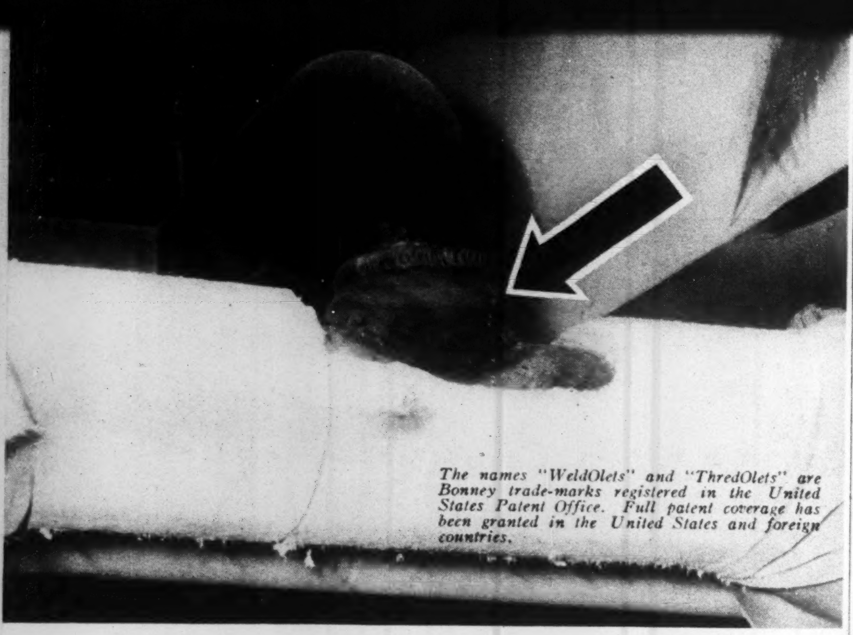
Write for Bulletin 578



A Typical Installation — Detroit Stoker at Bridgeport Conn. Plant

DETROIT STOKER COMPANY

Fifth Floor, General Motors Building, Detroit, Michigan • Works at Monroe, Michigan
District Offices in Principal Cities • Built in Canada at London, Ontario



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For Branch Pipe Connections

BONNEY WELDOLETS·THREDOLETS

WELDING has become the accepted method of making piping installations, and WeldOlets and ThredOlets are the accepted fittings for making branch pipe connections by welding.

Branch outlets made with WeldOlets and ThredOlets are strong, permanent and absolutely leak-proof. All cutting, threading and fitting of the main pipe is eliminated. Preliminary layouts of the main pipe are unnecessary. No templets are used.

The funnel shaped outlets of WeldOlets and ThredOlets provide free, unrestricted flow. Their heavy, external rib compensates for loss of strength in the main pipe when the hole is cut, and distortion is entirely eliminated.

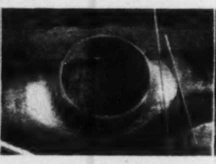
Available from stock in size-to-size or reducing sizes from ½" to 12". They are as adaptable to maintenance work as to new construction, whether indoors or out, above or below ground. Standard fittings are of drop-forged steel, but for special applications they can be supplied in Wrought Iron, Toncan Iron, brass, Monel, Everdur, in fact in any metal that can be forged.

Bulletin WT23 tells all about them. Write for your copy today.

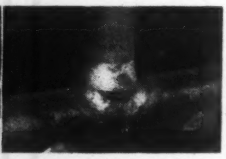
They are easily installed!

WeldOlets and ThredOlets are quickly and easily installed. Select the position of the outlet anywhere on the main pipe, mark center lines and tack the fitting into position.

Then weld by electric-arc or oxy-acetylene method. A leak-proof joint of full pipe strength is obtained.



On 2" outlets or larger the button is removed after installation. A full inspection of the inside of the joint is possible when WeldOlets and ThredOlets are used.



A simple Vee weld is used for attaching the branch when WeldOlets are used. If ThredOlets are used, the branch is screwed into position.

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WELDOLETS·THREDOLETS
. . . *Welded Outlets for Piping* . . .
Stocked by Leading Distributors

other, or from a chair to a bed. Therefore, it is important not only to have the optimum temperature and humidity, but to maintain this constantly. We need to know much more as to what constitutes the optimum temperatures and humidities for various conditions. There is considerable evidence to prove that the anaesthesized patient should be kept in a room at a somewhat higher temperature and humidity. Such studies would help greatly in preventing surgical shock. There are many more things we need to know in regard to the relationship of the patient and the atmospheric conditions, and this can only be determined by careful research work, which I hope will be carried out in the Corey Hill hospital.

Arthritis and Rheumatic Fever

We have been able to make certain clinical observations that were very gratifying. In patients suffering from arthritis and rheumatic fever, we know that a warm, dry atmosphere is beneficial. The patients who were in the hospital during the bad months, such as late winter and early spring, showed definite symptomatic as well as clinical improvement and lost their ability to predict the weather, which is so notorious among patients suffering from rheumatic diseases. The allergic patients (those patients suffering from conditions such as asthma and hay fever) have been very dramatically benefited by their stay in the hospital. There has been considerable skepticism in regard to treating patients by the use of air conditioning, because it is pointed out that the patient is unable to continually live in air conditioned surroundings. However true this may be, we have learned that the patients suffering from severe attacks of asthma are resistant to almost any type of treatment instituted at that time. It is only possible to determine what conditions are the most aggravating factors when the patient has been quieted down and is able to breathe somewhat normally. This can only be brought about in the severe cases by an air conditioned environment.

The results with the patients treated in this manner have been uniformly good and about 15 per cent of these patients have been sent home to an air conditioned bedroom. By spending part of each day in an air conditioned environment they have been able to maintain the improvement gained. Many of them are carrying on their normal activities. It is also extremely important to patients who have a history of asthma or hay fever to be in an air conditioned environment if they have to undergo a surgical operation. Frequently the asthmatic patient who is not suffering from asthma at the time may have an attack precipitated as a consequence of anaesthesia. Such a misfortune greatly complicates the surgeon's procedure and is a real hazard to the patient's recovery.

Sinus Infections, Pneumonia, Etc.

Members of the staff have commented upon the improvement noted in upper respiratory diseases when the patients are kept in an air conditioned environment. Sinus infections, middle ear infections, pneumonia, etc., have all shown gratifying results that could not be accounted for by the usual medical and hospital procedures. During the hot, humid days the ability to control the temperature and humidity within the hospital has made it a very important refuge for patients suffering from heart disease, kidney disease, high blood pressure and other chronic conditions. It is generally known that deaths reported as a consequence of a heat wave do not occur among people in good health. People who succumb during such heat are invariably those who have some physical ailment. Patients who had suffered an attack of heart failure brought on by the hot, humid weather improved very dramatically within one or two hours from the time they arrived in the hospital. This was also noticeable in severe cases of high blood pressure and kidney diseases.

These are all clinical observations and must be corroborated by careful scientific investigation. If the air conditioning industry is to develop on a sound basis, it is important to know what is most valuable to the well individual and to the ill patient. The results we have to date are important because we have learned that it is possible to maintain the physical conditions within the building, which I outlined in the beginning of my talk, and that by maintaining these conditions definite clinical improvement can be obtained for a great many patients. It is also important to know that the cost of maintaining the air conditioning within the building does not prohibit its use. Our costs have been higher than they should be, but most of this we can correct. Much more should be done in the way of engineering study to determine what is the most economic method of maintaining such a system. It is quite possible that the dehumidifying equipment will have to undergo a rather drastic change. We believe that the substitution of oil burners for coal will decrease our cost noticeably. It is also possible to improve the conditions by putting awnings on certain windows where the sun strikes in the afternoon.

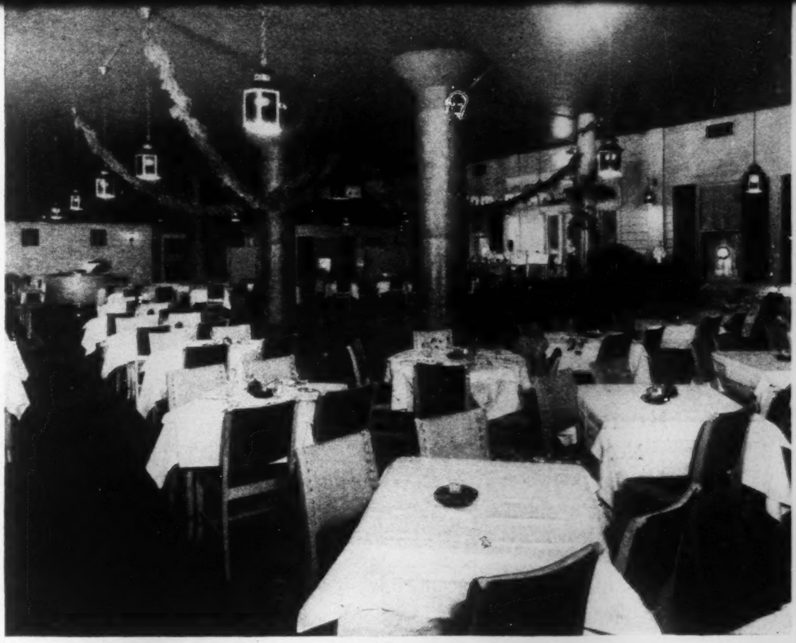
Air Conditioning a Real Adjunct

I am thoroughly convinced that air conditioning is a real adjunct to the hospital treatment of patients, but it must not be looked upon as a panacea, but merely as an added tool to help us in our fight against disease. It can also be an important adjunct from the standpoint of preventive medicine. It is generally known that the city dweller suffers more from diseases of the respiratory tract than those people who live in the country. Much of this is due to irritating substances which are constantly being poured into the city air. It would be impossible to remove all of this, but filtration of part of it would be a real help to the individual. I believe the time will come when it will be just as great a crime to pollute the city atmosphere as it is to pollute the city water supply.

In regard to public schools, we already have schools for crippled children, for the blind, and for the mentally defective; but we do not have schools to take care of the large number of children who suffer from such diseases as rheumatic fever, asthma, hay fever and allied conditions. It would be a very simple procedure to have a few air conditioned schools to take care of these children. Certainly they have as much right to an education as the other unfortunates I have mentioned, and properly cared for they would have a better prospect of taking their place in the world when they became adults. I am convinced that the future will bring forth such schools.

Briefly Noted

Sections of the revised Chicago code of 1931 relating to refrigeration, with amendments up to and including December 29, 1937, are available in mimeographed form for 25c a copy from the Municipal Reference Library of the City of Chicago, 1005 City Hall, Chicago, Ill. An index is included. . . . The American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., has recently published a "Symposium on Significance of Tests of Coal," which includes six extensive technical papers and considerable discussion presented at the annual meeting of the A.S.T.M. last June. Bound in a paper cover, copies of this 132 page publication are available at $1.00 from the A.S.T.M. . . . The Copper and Brass Research Association, 420 Lexington Ave., New York, N. Y., has issued a 44 page "Copper Tube Handbook," by T. N. Thomson, consulting sanitary and heating engineer, giving handbook information on heating and plumbing for the engineer, architect, and contractor. . . . His Majesty's Stationery Office, London, has published Leaflet No. 1 in the series on methods for the detection of toxic gases in industry on hydrogen sulphide, copies of which are available from the British Library of Information, 270 Madison Ave., New York, N. Y., for $1.10. It comprises a six page bulletin with a large chart showing a hand pump attachment for detection of toxic atmospheres, and an inserted sheet showing the standard stains produced on lead acetate paper.



Dollars for Degrees

"Our patronage was not only increased, but a higher average check is paid, indicating that our patrons enjoy the cool, clear atmosphere . . . . "

So writes Joe Maggeo of Kansas City's popular Southern Mansion, Inc., concerning the cash value—from the profit angle—of Vilter Air Conditioning.

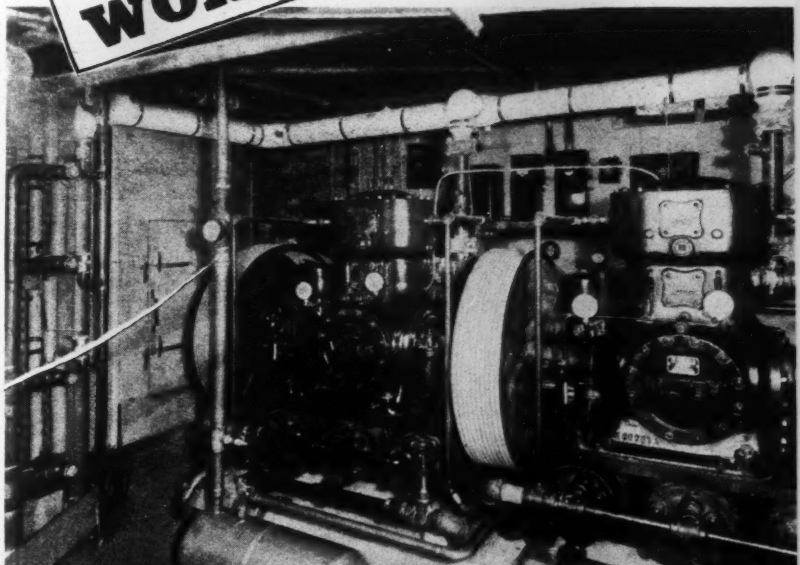
And so the smooth, draftless performance of Vilter Air Conditioning Equipment chalks up another satisfied user to the ever-increasing roster.

Vilter Equipment is built to exactly meet the individual requirements of its ultimate installation. Be sure to specify "Vilter" for every job—it produces the results you expect.

VILTER Equipment at WORK

The Vilter Manufacturing Co.
2148 South First Street, Milwaukee, Wis.

The scenes above and below, taken at Southern Mansion, Inc., Kansas, City, Mo.

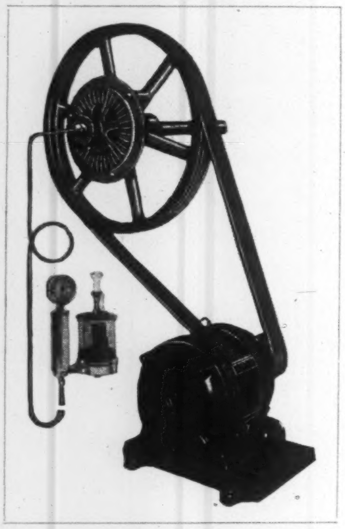


Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 142.

Variable Speed Pulley and Hydraulic Remote Control

No. 1419*—For blowers requiring from 3 to 30 hp, a new blower pulley and clutch mechanism is offered, with which it is possible to obtain a range of speeds from idling to maximum pulley ratio. It is a friction type of clutch controlled by the pressure carried on a diaphragm contained in the pressure unit which is screwed on to the end of the blower shaft.

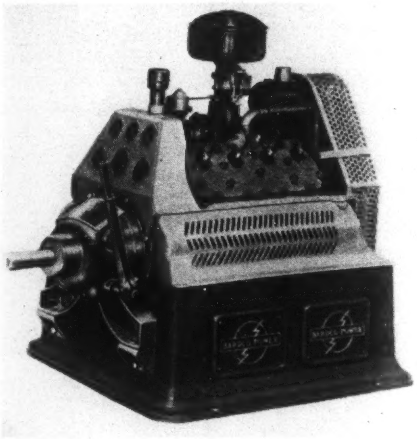


The pressure is varied by the operator by manipulation of the pump unit which can be remotely located at any convenient point. The blower pulley is not keyed to the impeller shaft but turns free on a tapered roller bearing and is driven at constant speed by the motor. Attached to a concentric with the blower pulley is a driving disc which also rotates at constant speed with the blower pulley.

Riveted to each side of the driving disc is a special asbestos friction disc of the correct area to transmit the load required at full speed. This driving disc rotates between a back and front pressure plate, each of which is keyed to the blower shaft. As pressure is applied on the diaphragm of the pressure unit, the pressure plates are forced against the friction surfaces of the driving disc and the speed of the blower is increased.—U. S. Air Conditioning Corp., 2101 Kennedy St., N. E., Minneapolis, Minn.

Power Unit Drives A.C. Equipment

No. 1420**—A new power unit for air conditioning and industrial equipment produces power for as low as ⅓ of a cent per hp-hr, says the maker. It is of compact design for either stationary or portable service. Choice may be had of a Ford V-8 or diesel engine. Natural or artificial gas, gasoline, distillate, butane, and diesel fuel may be used.



Features include oversize oil re-refining unit to save oil drains eliminating carbon, excess dilution and acid, and automatic safety controls to protect the equipment from low oil or water supply. In case of danger, the engine is stopped by the safety controls, and they can be set to give a warning signal at any predetermined point.—Bardco Corp. of America, 6670 Lexington Ave., Los Angeles, Calif.

LINING DUCTS for Sound Absorption?

...Make sure you get FIRE and MOISTURE RESISTANCE, too!

JM Johns-Manville
AIR ACOUSTIC SHEETS FOR DUCT LINING

REPORTS of fires taking hold on combustible duct linings and causing serious damage come as a warning from the National Board of Fire Underwriters!*

With life and property in danger, the use of a material that provides fire-safety, as well as sound absorption, becomes a necessity.

J-M Air Acoustic Sheets perform exactly that function. This sound-absorption material cannot burn or smolder . . . will never contribute to fire spread. And being moisture resistant, Air Acoustic Sheets are exceptionally free from the dangers of humidity.

Furthermore—their high rate of sound absorption (up to 80%) . . . light weight, assuring easy handling and application . . . the permanence of their mineral composition . . . their high transverse strength and low thermal conductivity . . . all make this material outstanding in its field. For complete data on J-M Air Acoustic Sheets, write Johns-Manville, 22 E. 40th Street, New York City.

*A recent bulletin from the N.B.F.U. reports several cases in which combustible duct linings caught fire and contributed to greatly increased loss.

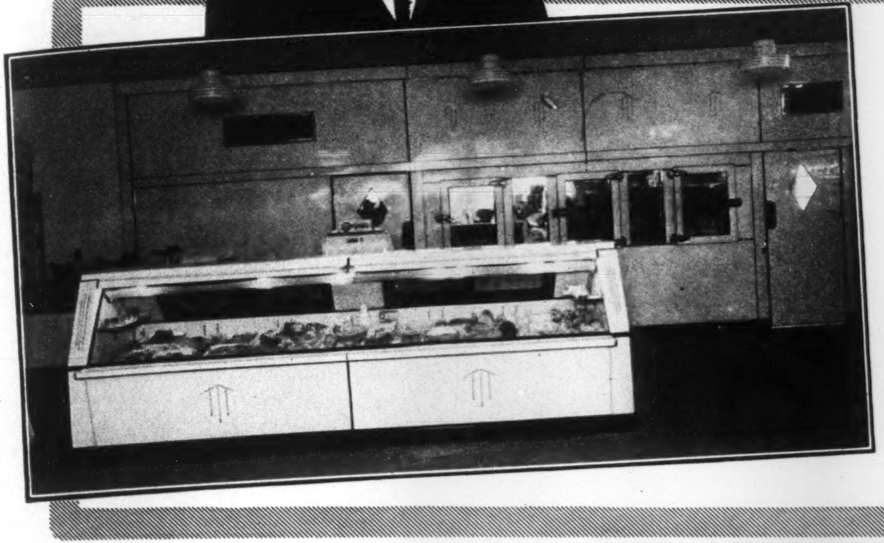
"Then I Switched to AP Valves . . .

. . . and Trouble STOPPED!"

(A typical remark from a Service Engineer)

"Here's one reason I prefer A-P Valves on all my 'Year's Warranty' installations.

"Superheat Adjustment on other valves is difficult and complicated. But not on the A-P. Just remove the bottom nut and your adjusting stem is right out in front of you."



The "Switch" to A-P Valves is spreading to all phases of air conditioning and refrigeration — from small commercial cabinets to huge hotel and industrial installations.

The Service Engineer working on every job can give you many reasons for A-P Preference—in definite terms of Service-Free and Trouble-Free operation.

A-P Refrigeration Valves are far ahead of their time in design and construction —in super-sensitivity, accuracy of control that invariably mean a Profitable Installation.

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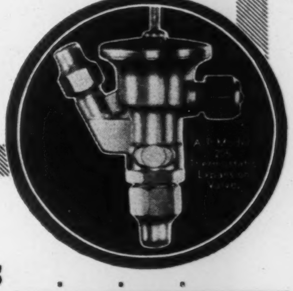
CABINET
Campbell Refrigerator Co., Milwaukee, Wis.

REFRIGERATION UNIT—York

VALVES—AP

Purchased Through Refrigeration Specialty Company, Milwaukee, Wis.



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THE BYWORD OF AP CONTROLS . . .

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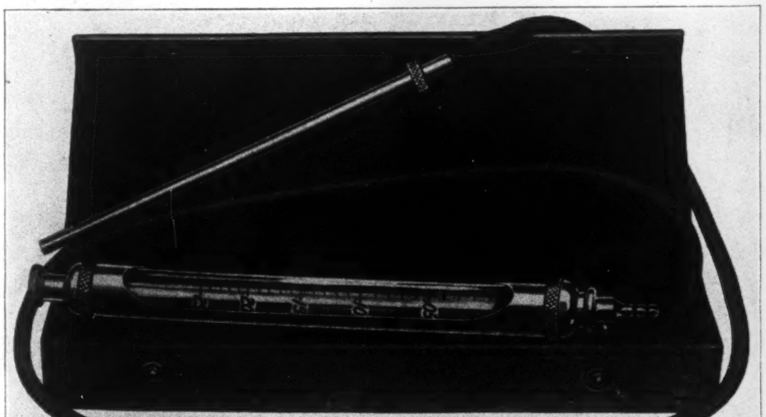
USE A GOOD GAUGE

DESIGNED SPECIFICALLY FOR THE WORK IT IS TO DO



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For Draft Readings

The smoke tube draft gauge meets every requirement.

No Liquids to Cause Trouble—No Moving Parts—No Leveling Required

Simply fill the tube with smoke from your cigar or cigarette, insert the static tip in the smoke pipe or wherever a reading is to be taken, and read the draft immediately, directly, without charts, tables or calculations.

Complete in attractive natural finish wood case, 9" × 3" × 1¼"

$7.50

Postage Prepaid.

For tan leather case add $2.00. (See Illustration)

This gauge has been found indispensable by the Oil Burner industry.

E. VERNON HILL 179 W. Washington St., Chicago

Of course
YOU WOULDN'T
BUT WATER AND
AIR-BINDING DO!

SUPER-SILVERTOP
STEAM TRAP

● Water blocked up in the bottom of a unit heater reduces the heat output just as effectively as boards nailed across the front. That is why you need complete condensate and air removal if you are to attain maximum heating efficiency. Anderson Super-Silvertop inverted bucket traps insure maximum efficiency. Their large capacity keeps the heater drained dry and free of air so that steam can fill the entire unit from top to bottom.

SIMPLIFIED PIPING—Connect Anderson Super-Silvertops either as elbow or straight-in-line. There are no extra fittings to buy or install, no extra labor costs.

CAPACITY—Compare the capacity of Super-Silvertops with other steam traps and you will see the value of Super-Silvertop construction details such as longer lever arm.

52 YEARS EXPERIENCE are back of Anderson Super-Silvertops...experience in steam traps and steam trap problems. This experience builds many years of life into every Anderson trap.

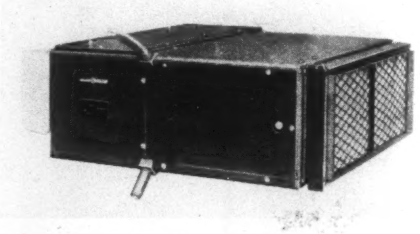
If you are interested in getting more heat from your unit heaters, it will pay you to investigate Super-Silvertop traps. Write

THE V. D. ANDERSON CO.
1935 West 96th Street • Cleveland, Ohio

SUPER-SILVERTOP

Announces Small Air Conditioner

No. 1421—New small unit assembly air conditioners for applications in apartments, business suites, and small retail stores were first displayed at the Fifth International Heating and Ventilating Exposition in January. The conditioners are additions to an extensive line of factory built and tested central plant units.



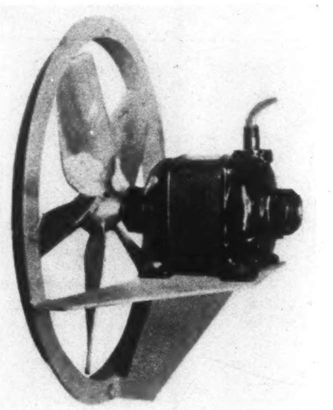
Rated cooling capacities, with 40 deg refrigerant and air at 80 F and 50 per cent relative humidity, range from 18,400 to 40,300 Btu per hr. Rated heating capacities, with 2 lb steam, are from 45,800 to 68,500 Btu per hr.

They may be had in two types, and there are 10 standard units listed for each type. Specially built conditioners in the same series are also available, incorporating special arrangements of standard parts or standard parts with minor variations in design.

Each air conditioner consists of three independent sub-assembly sections, bolted together to form the complete unit. These sections are the frame and enclosure, which houses the heat transfer surfaces and the humidifier; the fan unit, which houses the spring mounted, directly connected fans; and the filter unit.—General Electric Co., Bloomfield, N. J.

Offers New Ventilating Fans

No. 1422*—A new line of exhaust ventilating fans is offered for stores, factories, work shops and plants of all kinds. They are not recommended where quiet operation is a requisite.

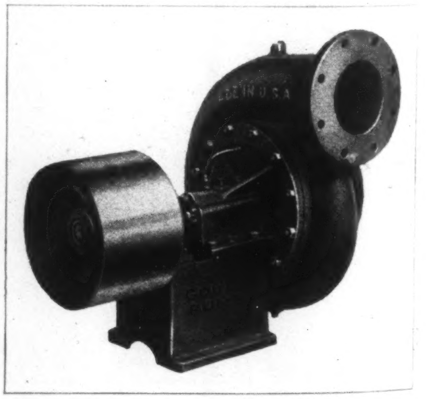


Furnished with guard over five bladed propeller. Can be easily put in place in a window, transom, or other opening by mounting a wood or metal frame around it. Explosion proof motors in various common specifications.

Sizes from 18 to 34 in. are available.—Binks Mfg. Co., 3114-40 Carroll Ave., Chicago, Ill.

Centrifugal Pump Line Improved

No. 1423—Recently announced line of single stage, side suction, ball bearing centrifugal pumps comprises 18 sizes with capacities from 5 to 1800 gpm against heads up to 110 ft for flat or V belt or direct motor drive. Modern hydraulic design is embodied in casings, impellers, and stuffing boxes, according to the maker, and structural strength and amply proportioned parts are provided without excess weight.—Goulds Pumps, Inc., Fall St., Seneca Falls, N. Y.



"Quiet as a graveyard"

When the duct is lined with Acousti-Pad

YOUR SAFEST WAY TO *Forestall Duct Noise*

- Your customers will never complain of duct noise if you use Burgess Acousti-Pad lining. It blots up air-borne noise just like a blotter absorbs ink. That is why you are sure of a satisfactory duct job when you install this sound absorbent.

Because Acousti-Pad is applied to the duct walls and has a smooth metal facing, it offers no resistance to air flow. Other advantages are fire resistance, complete freedom from odors, and easy installation.

You will find it easy to determine the correct amount of lining for each duct. No calculations are necessary if you use Burgess data sheets. They give you direct readings of the necessary footage.

Adopt the safest way of forestalling duct noise. Use Burgess Acousti-Pad duct lining on every job. Write to us for complete information on installation methods, prices, and source of supply. Ask for the Duct Quieting Bulletins.

Write for Free Copy
BURGESS ACOUSTI-PAD
BURGESS

Burgess Battery Company
(Acoustic Division) Dept. H
111 W. Monroe, Chicago, Ill.
In England—
Burgess Products Co., Ltd.
Barwell, Leicester
Licensed under C. F. Burgess Laboratories, Inc., Patents

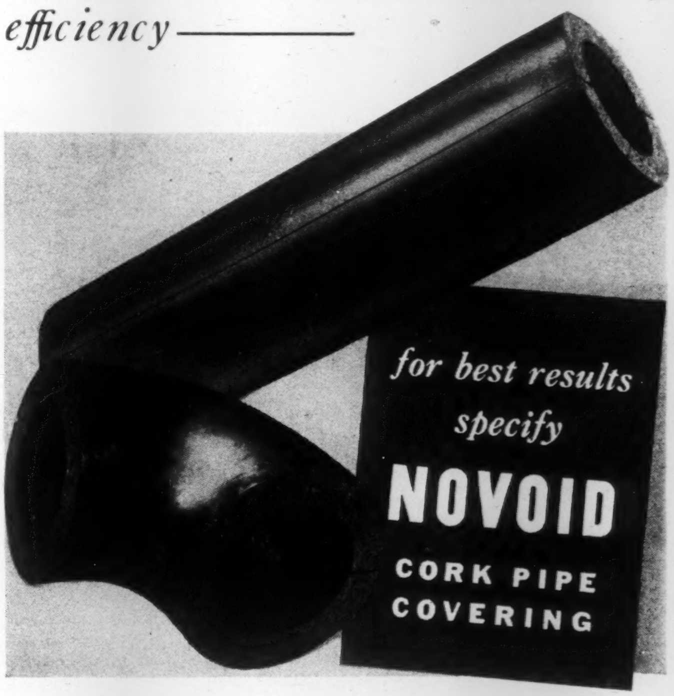
OUR CATALOG IS FILED IN SWEET'S

BURGESS ACOUSTI-PAD

FOR ABSORBING DUCT NOISES
IN AIR CONDITIONING SYSTEMS

CORK COVERED PIPE LINES

assure maximum air conditioning efficiency——



WHEN CORK, nature's best insulator, is used to cover air conditioning pipe lines, you can be sure of increased efficiency, more accurate control of temperatures, and lower operating costs. That is why Novoid Cork Pipe Covering is so widely used in the air conditioning industry.

Properly installed on cold water risers, return lines, and attendant piping, Novoid effectively resists the penetration of heat and moisture, and prevents condensation. It is carefully machined to fit pipes snugly and is moisture-proofed with an asphalt mastic coating.

Novoid Cork Pipe Covering and Novoid Fitting Covers are furnished in a complete range of standard pipe sizes. For special fittings, Novoid Fitting Covers can be fabricated to order. Novoid Welding Ell Covers (90° to 45°), are also available in sizes to fit all makes of welding ells—long or standard radius. For temperatures above 35° F., light-weight, ice water thickness is adequate and reduces weight on the line and hangers.

When you specify Novoid you are assured of a lasting, tailor-made job that will soon repay its cost in increased operating efficiency of air conditioning units. For complete information, mail the coupon below.

CORK IMPORT CORPORATION

330 West 42nd Street, New York City

Mail coupon for full details

Cork Import Corporation
330 West 42nd Street, New York City

Please send me complete details of Novoid Cork Pipe Covering for air conditioning piping.

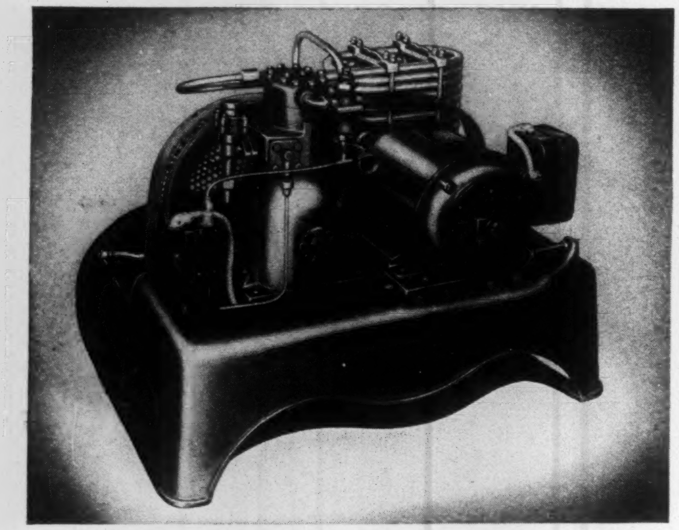
Name ....

Street ....

City and State..

SUMMER COOLING

is a GROWING *business*



safeguard SALES *and* PROFITS *with* UNIVERSAL COOLER *units*

A tabulation of the residential cooling installations in 55 cities shows that of the 4,000 jobs installed to date, 1,500 or 37½ per cent were sold last year. Conservative estimates place 1938 sales at 3,000 jobs . . . an increase of 75 per cent over the total number now in use.

The rising trend of Summer Cooling points the way to new profits for manufacturers of air conditioning equipment and air conditioning furnaces who are in a position to offer the trade matched, factory engineered units of proved design and performance.

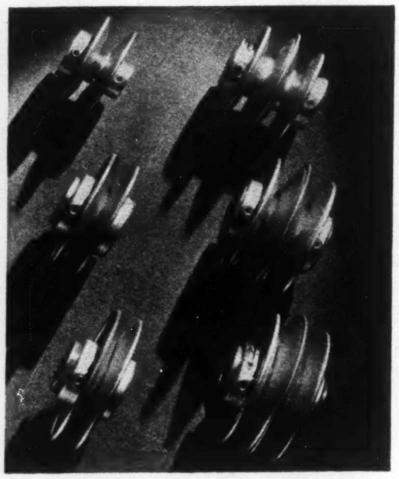
To such manufacturers, UNIVERSAL COOLER offers the most modern type of condensing units, in all sizes and capacities from ¾ h.p. to 15 h.p., painted any color and carrying your own name plate. Backed by 16 years' experience in building commercial electric refrigerating machinery for many of the leading manufacturers in the industry, we are exceptionally well fitted to assist in the engineering, selection and arrangement of refrigerating units to match your own equipment. Make our factory . . . your factory! For complete details, write to UNIVERSAL COOLER CORPORATION, Commercial Sales Dept., Detroit, Michigan. In Canada: Universal Cooler Company of Canada, Ltd., Brantford, Ontario.

UNIVERSAL COOLER

Suppliers of quality refrigerating machines to the air conditioning industry

Adjustable Pitch Diameter Sheaves Vary Speeds

No. 1424—New two groove adjustable pitch diameter, "texsteel" sheaves for a speed variation up to 33 per cent on any driven unit provide a sturdy, inexpensive, easily adjusted, variable speed drive for applications where the required load does not exceed 3 hp, states the maker. They are now available in three sizes of 2 to 3 in., 2.5 to 3.5 in., and 3.5 to 4 in. variations.



The pitch diameters on these sheaves are changed in a moment by stopping the motor, relieving the belt tension, releasing the head locking screw, and turning the adjustable plate in or out to the desired pitch diameter. The sheaves are furnished complete with a wrench for the "Allen" head locking screw and a circular calculator showing directly the speeds of the driven unit.

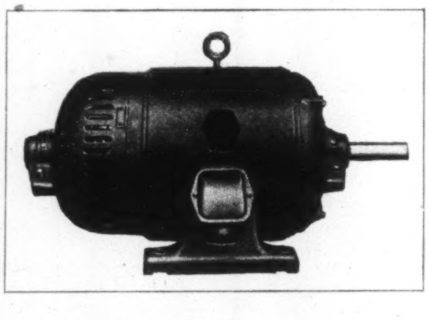
The sheaves have several improvements in construction. The stationary part of the hub is cast integrally around the steel plates to prevent hard usage or abuse loosening them. The movable portion of the hub is similarly constructed with sufficient material to form an external brace on the outside plate to assure a smooth, true-running sheave at all times.

The maker has also added an intermediate diameter "texsteel" sheave to its single groove adjustable pitch diameter series, also with a speed variation of 33 per cent for ratings up to 1½ hp.

Both the single and double groove adjustable pitch sheave series have many applications in connection with small commercial units of various kinds, including heating, ventilating and air conditioning.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

New Motor Completes Line for Air Conditioning Service

No. 1425—For localities where double squirrel cage motors of the larger sizes would produce undesirable voltage variations and it is desirable to have a motor available which meets rigid starting current requirements, the type "RT" motor has been developed. It is designed to possess the desirable features of comparatively low starting current, high starting torque, satisfactory operating characteristics, and good speed regulation. It has a locked torque of about twice full load torque and a locked current of from three to three and one-half times full load current.



This motor is available in a large variety of ratings but will ordinarily be built only in sizes 40 hp and larger, because in most localities the use of double squirrel cage motors of 30 hp ratings and smaller is approved by the power company, the maker says. The "RT" motor completes the line of polyphase motors produced by its manufacturer for air conditioning service.—Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo.

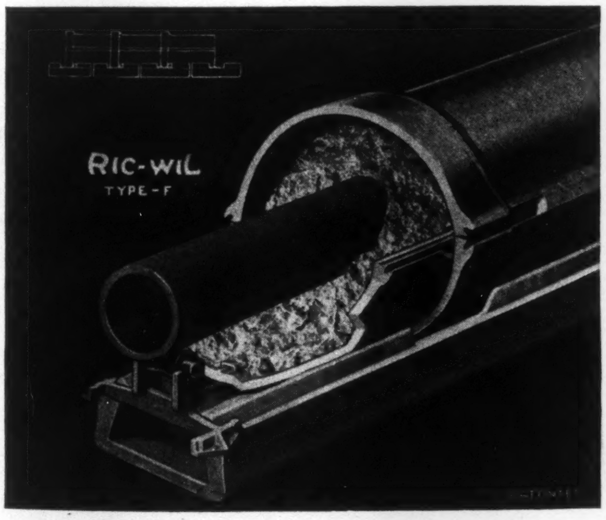
WET OR DRY?

NO matter what the law may say on "suds" or high-balls, one place that must always be voted DRY is an underground steam line There a tight, dry conduit installation is all-important. Only with such a job—adequately engineered, properly drained and insulated—will you receive maximum efficiency (over 90%) from your steam lines. In the opinion of most qualified engineers, that means a Ric-wiL Tile or Cast Iron System, insulated with genuine waterproof asbestos Dry-paC. Get the FACTS—then act accordingly.

Ric-wiL comes in various designs in standard or extra-heavy Tile, and also in Cast Iron. Ric-wiL keeps steam lines over 90% efficient. Basic features are *closed construction*, adequate under-drainage, Loc-liP side joints, improved pipe supports, and certified Dry-paC waterproof asbestos insulation. Sectional pipe covering may be used if desired. Ric-wiL service covers engineering, manufacture, and installation and is nation-wide. Write for latest Bulletin and Dry-paC sample.

The Ric-wiL Co., Union Trust Bldg., Cleveland, Ohio
New York San Francisco Chicago
Agents in principal cities

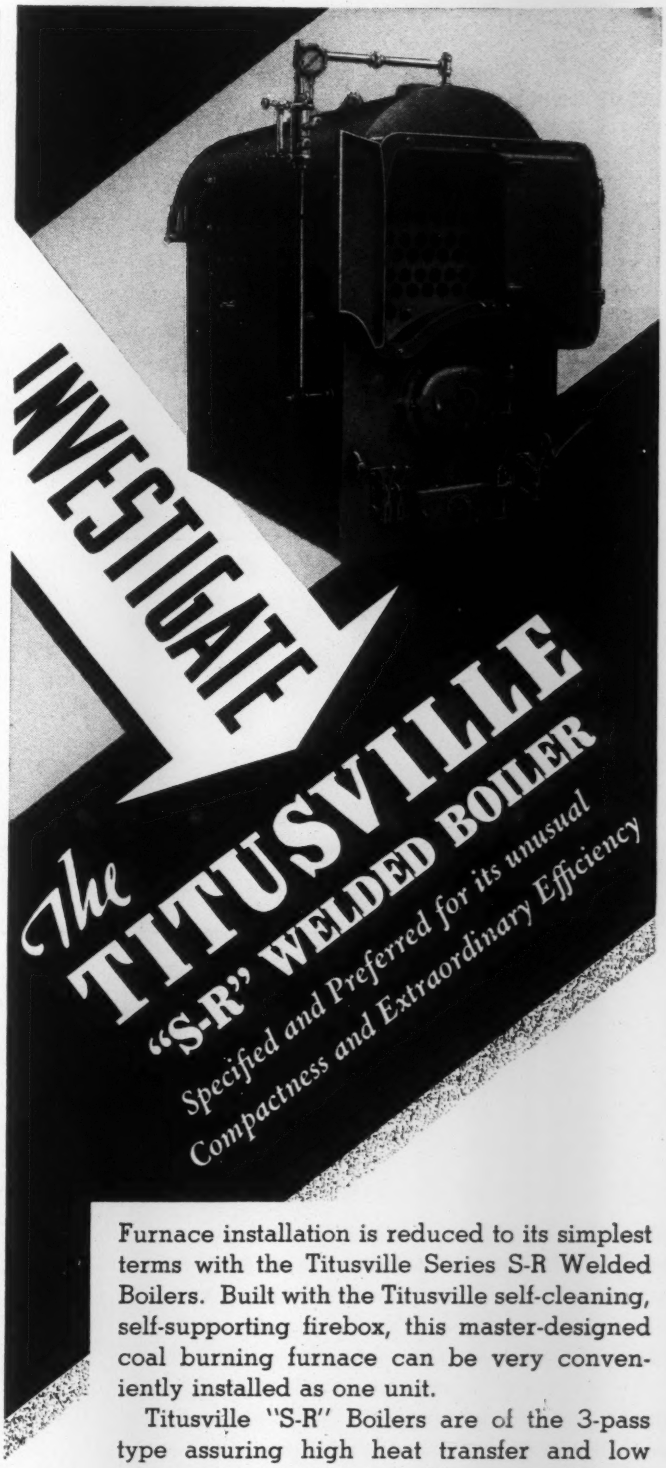
Standard Ric-wiL conduit is assembled on the job—materials and workmanship completely open to inspection.



REGISTERED IN U. S. PATENT OFFICE

·RIC-WIL·

CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES


INVESTIGATE
The TITUSVILLE
"S-R" WELDED BOILER
Specified and Preferred for its unusual Compactness and Extraordinary Efficiency

Furnace installation is reduced to its simplest terms with the Titusville Series S-R Welded Boilers. Built with the Titusville self-cleaning, self-supporting firebox, this master-designed coal burning furnace can be very conveniently installed as one unit.

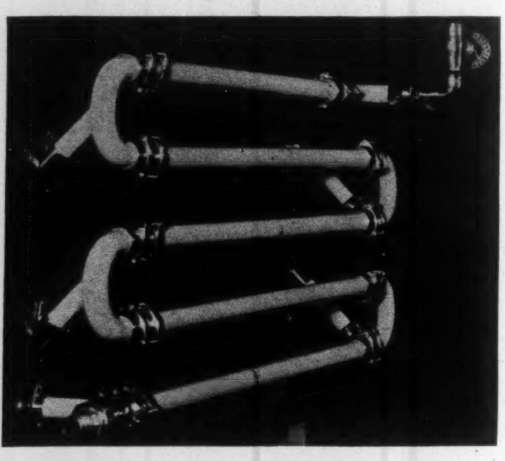
Titusville "S-R" Boilers are of the 3-pass type assuring high heat transfer and low temperature stack gases. Moreover, all heating surfaces are under water, making this Titusville unit most effective for steam production.

Get in touch with your nearest Titusville office or write direct for descriptive Bulletin No. 9090.

The TITUSVILLE IRON WORKS CO.
Division of Struthers-Wells Titusville Corporation
TITUSVILLE, PA.

Porcelain Pipe Resists Acids

No. 1426**—Porcelain pipe was announced recently for the transmission of liquids where the problem is one of acid resistance, strength, durability or display appeal.

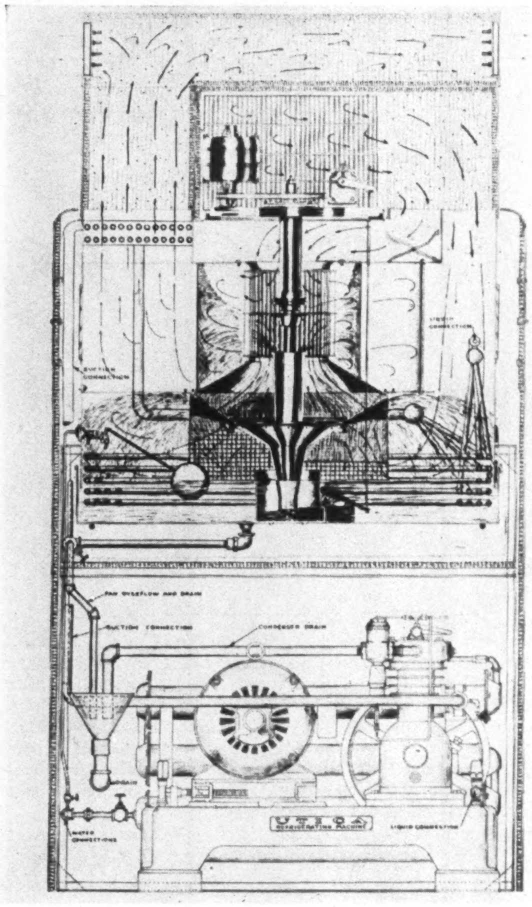


The pipe is glazed, both inside and outside, and according to the manufacturer, is highly resistant to all acids, except concentrated solutions of hydrofluoric acid. The pipe may be supplied in straight lengths with 90 deg and 180 deg bends and suitable connectors for joints.

The maker states that porcelain is non-porous and non-absorbent so that a scratch or a crack will not allow liquid to be absorbed or contaminated.—Lapp Insulator Co., Inc., Le Roy, N. Y.

Washed Air Conditioner Available in Three and Five Ton Sizes

No. 1427—Shown for the first time at the International Heating and Ventilating Exposition in New York was the "Air Clipper," a self contained washed air conditioner for commercial use that is being produced in 3 ton and 5 ton capacities.



1 2 3 **4** 5 6 7 8 9 10 11 12 13 14 15

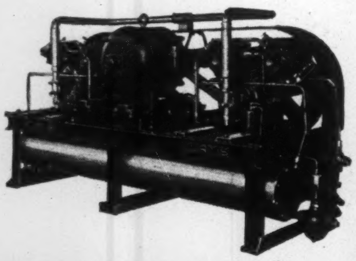
No. 4 of a Series of Curtis Advanced Engineering Features.

CURTIS DROP FORGED CRANKSHAFTS AND CONNECTING RODS—ANOTHER CURTIS FEATURE THAT REDUCES OPERATING COSTS

One of the major contributions to the high efficiency of the Curtis compressors is the Curtis practice of using only drop forged crankshafts and connecting rods. These cut down friction, prevent motor burn-out in starting after long shutdowns, provide adjustment for wear and make for quiet, vibrationless operation.

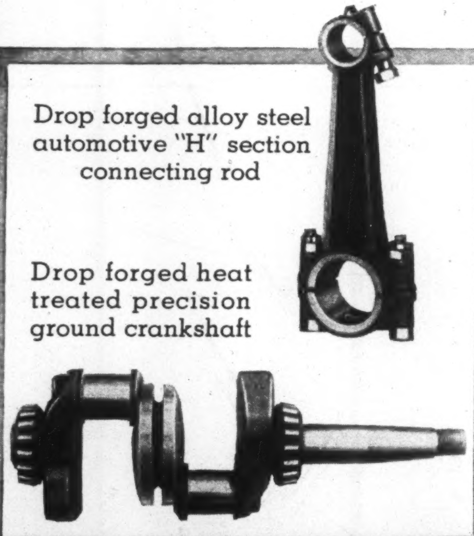
This is but another example of the quality and precision that is built into the design and manufacture of every Curtis unit.

There is a Curtis model for every air conditioning and refrigeration need—from 1/6 to 30 H. P., air and water cooled. In thousands of installations throughout the world, Curtis quality is giving economical trouble-free performance under a variety of operating conditions.



Write to Curtis for full details.

CURTIS REFRIGERATING MACHINE CO.
Division of Curtis Manufacturing Co.
1950 KIENLEN AVENUE ST. LOUIS, MO.



Drop forged alloy steel automotive "H" section connecting rod

Drop forged heat treated precision ground crankshaft

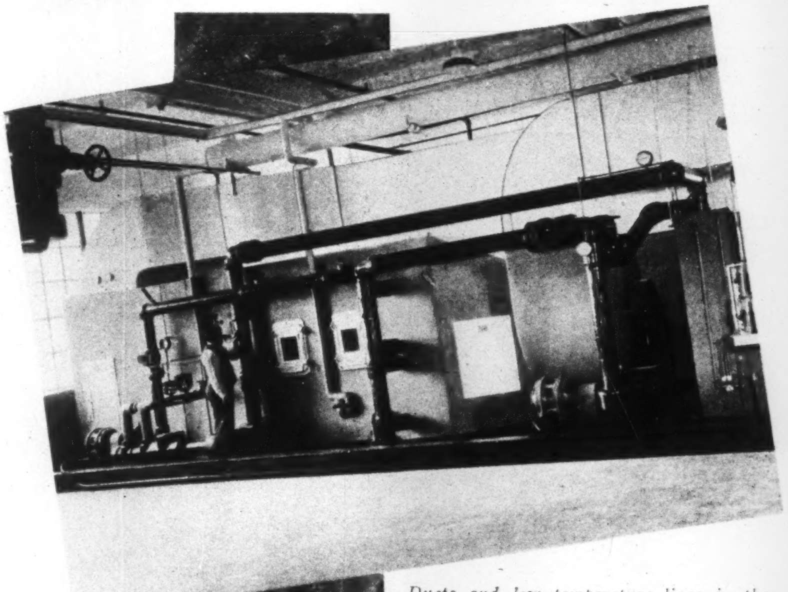
CURTIS

"Builders of Condensing Units Since 1922"

Represented in Canada by
Canadian Curtis Refrigeration Co., Ltd.
20 George St., Hamilton, Ont., Can.

Lower Air Conditioning Costs with

MUNDET CORK INSULATION



Ducts and low temperature lines in the above air conditioning unit have been insulated with Mundet "Jointite" Corkboard and Cork Pipe Covering.

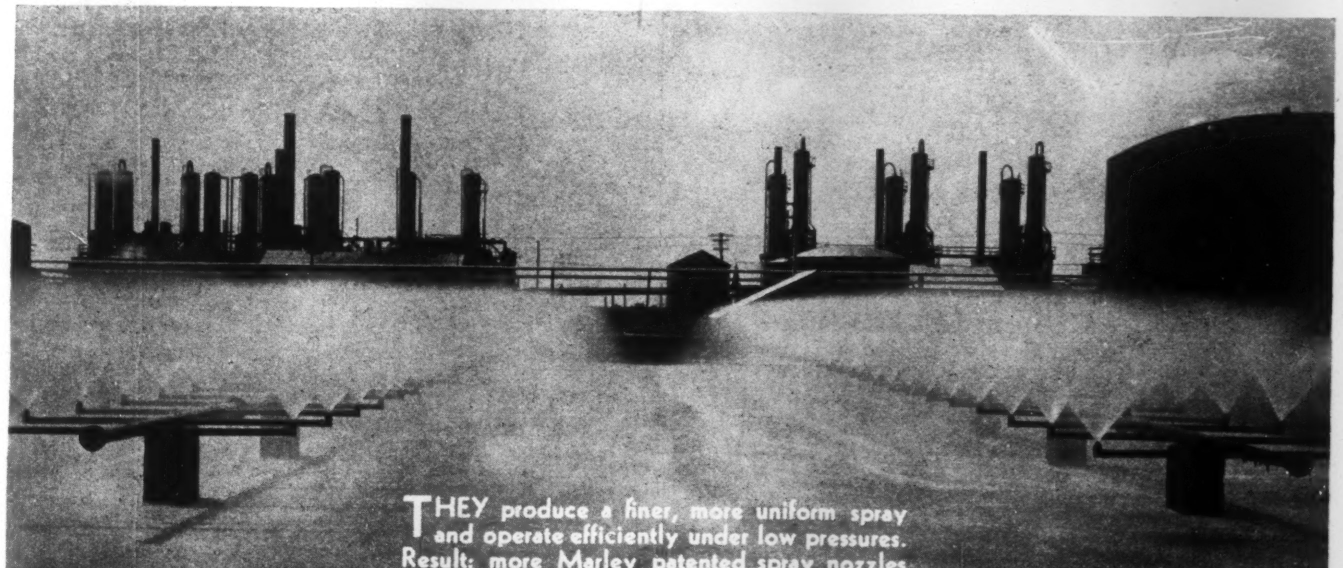
Mundet Corkboard provides a natural and permanent barrier to heat flow. Its high efficiency permits air conditioning users to enjoy the comforts and economy of precise temperature control. In air conditioning, as in commercial refrigeration, this 100% pure Cork insulation soon pays for itself.

Our engineering department will assist you with specification details and recommendations covering Cork insulation. See our complete Catalog in Sweets or write for individual copy.

SOLVE VIBRATION TROUBLES with Mundet Natural Cork Mats. The easiest, most efficient way to isolate machinery vibration. Full particulars on request.

MUNDET CORK CORPORATION

INSULATION DIVISION 65 South 11th Street, Brooklyn, N. Y.
Offices in Principal Cities

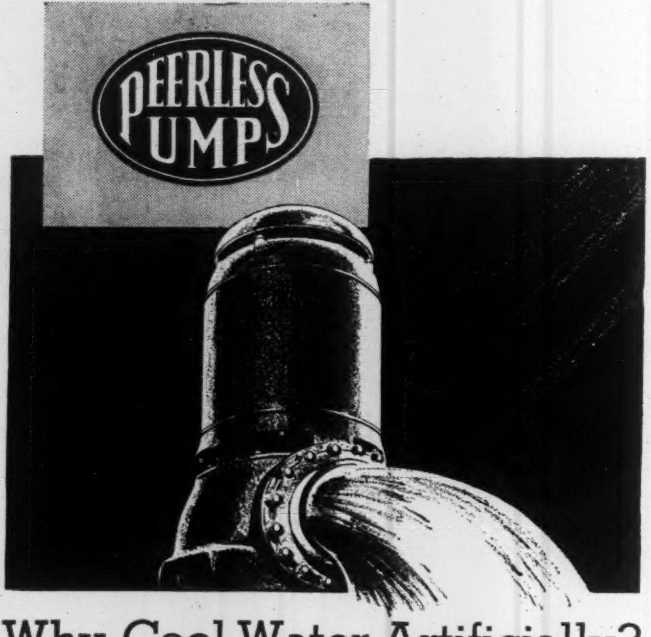


THEY produce a finer, more uniform spray and operate efficiently under low pressures. Result: more Marley patented spray nozzles are sold than any other kind.

THE MARLEY COMPANY, Kansas City, Mo.

MARLEY

PATENTED SPRAY NOZZLES



Why Cool Water Artificially?

Now you can have an ample supply of COLD water this summer without resorting to expensive spray ponds and cooling towers. Peerless Deep Well Pumps tap the inexhaustible underground flow, usually delivering water 15° to 30° colder than the city mains. This better, more dependable water supply actually costs you less per gallon. Facts and figures on request.

PEERLESS PUMPS
FOOD MACHINERY CORPORATION
Los Angeles, Calif. Massillon, Ohio San Jose, Calif.

UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free.
COPR. 1937
THE RIDGE TOOL CO. ELYRIA, O.
Look! a new RIDGID

Guaranteed Stronger and Safer than Ever!

Here's a tool for you expert pipe wrench users who can't be fooled by shiny metal and ordinary guarantees — the new all-alloy RIDGID with new design stronger housing and I-beam handle that adds still more strength to the famous unconditional guarantee.

It practically stops your pipe wrench repair bother and expense.

With its replaceable no-slip, no-lock chrome molybdenum jaws and unbreakable housing, you've got a wrench you can depend on for any job, in any emergency. Add the pleasure of an adjusting nut that spins freely in all sizes, 6" to 60", a handy pipe scale on the full-floating hook jaw, handle that's comfortable to your hand on a hard pull, and you see why RIDGID is the wrench millions enjoy owning and using.

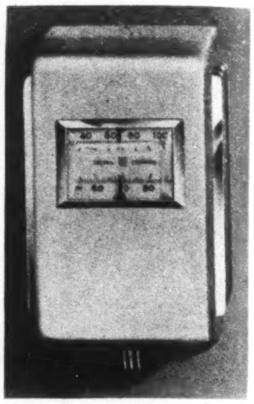
Buy from your Jobber.

THE RIDGE TOOL CO.
ELYRIA, OHIO, U. S. A.

The unit embodies all of the principles of air washing as employed in the maker's other air conditioners. A specially designed refrigerating compressor is housed at the bottom of the same cabinet which contains the washing sprays. A new type of intake and discharge header is used on the top for delivery of air in three directions, if desired. Provision is also made for outside air intake connections.

The unit includes all equipment necessary for year 'round, self contained washed air conditioning for stores, beauty shops, and other commercial and industrial service, says the maker.—Utica Radiator Corp., 2201 Dwyer Ave., Utica, N. Y.

New Room Thermostat for Line Voltage



No. 1428—A new line voltage room thermostat just announced is similar in appearance to the maker's low voltage "Metrotherm" and is finished in a soft satin silver and chrome.

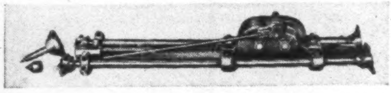
An accurate bimetal thermometer is incorporated, giving quick response, greater visibility and elimination of breakage or separation of liquid, according to the manufacturers. Electrical ratings are 5 amp, 110 v; 2½ amp, at 220 v. Locking device is standard.—General Controls Co., 450 E. Ohio St., Chicago, Ill.

Variable Speed Fan Motor Features Display

No. 1429—Particularly adapted to carrying air conditioning fan loads, a new, variable speed, split phase capacitor motor was featured at the International Heating and Ventilating Exposition at New York in January. Also included in the maker's exhibit were other fan, pump, and compressor motors, different applications of control, electrically operated valves, ignition and control transformers. The display emphasized the benefits resulting from the use of co-ordinated electrical parts built by one manufacturer.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Saves Pipe Laying Time

No. 1430—Time and labor saving advantages in the laying of pipe lines are afforded through the use of a new pipe pulling and pushing jack, says the manufacturer.



Designed primarily for pulling and pushing without changing the position of the jack, this geared type unit is capable of forcing pipe up to 6 in. in diameter. The tearing up of lawns, streets, highways or holding up of railroad traffic is obviated by its use.—Duff-Norton Mfg. Co., 2709 Preble Ave., Pittsburgh, Pa.

Non-Metallic Heat Exchangers Cool Corrosive Liquors

No. 1431—Two unusual heat exchangers of the shell and tube type, with full floating heads and removable tube bundles, have recently been developed for cooling a very corrosive, weak acid solution.

The special feature of these units is that all material coming in contact with the acid solution is either of impervious graphite or rubber. Tubes and tube sheets are of graphite, the heat conductivity of which is comparable with that of steel and is unusually high compared with ordinary carbon. This particular graphite is quite strong and the tubes will withstand a moderate

DUX-SULATION

The last word in Engineered-Insulation for Sheet Metal Duct work . . . Air-Conditioning or Warm Air . . . It's ***asbestos protected*** . . . flexible . . . complete . . . low priced . . . easy to apply . . . 100% contact with metal . . . comes in a roll of 100 square feet, 36″ wide . . . cuts with a knife or snips . . . prevents condensation . . . saves fuel . . . looks good . . . easy to handle on the job . . . the BIG jobs are going in with DUX-SULATION specified.

A Typical
Job of
Dux-Sulation
in the plant of
SHAW-WALKER CO.
Muskegon, Mich.

Dux-Sulation A PRODUCT OF
GRANT WILSON INC
4101 TAYLOR ST. · · · CHICAGO

Consider these Superior Points about

AEROFIN

Heat-Exchange Surface

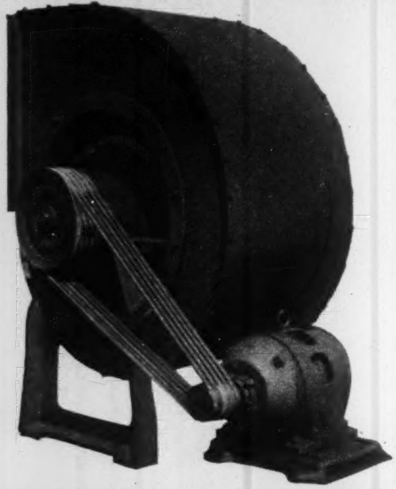
1. **Flexitube Aerofin has a core which is completely nonferrous, having copper tubes and cast bronze headers.**
2. **Flexitube Aerofin has patented joints between tubes and headers which are brazed at 1200° F., the resulting bond being stronger than the tube itself.**
3. **Flexitube Aerofin has a patented crown type orifice in steam end of each tube, which assures adequate steam supply at all times and prevents clogging of the tube inlet by scale.**
4. **Flexitube Aerofin has offset bend in each tube to relieve differential expansion and contraction strains in the tubes, thus putting no strain either on tube or joint.**

Send for descriptive literature.

Flexitube Aerofin

AEROFIN CORPORATION
410 SOUTH GEDDES STREET
SYRACUSE, N. Y.
Chicago • Detroit • New York • Philadelphia • Dallas • Atlanta

1878 Sixty Years EXPERIENCE 1938
FANS & BLOWERS for ALL PURPOSES
Certified Performance
Rugged Dependable Construction
Prompt and Complete Service
LET US HELP SOLVE YOUR AIR PROBLEMS!



GARDEN CITY FAN CO., *Mfrs.*
332 SO. MICHIGAN - CHICAGO, ILLINOIS
N. A. F. Member
NEW YORK - DETROIT - CINCINNATI - MILWAUKEE
Send for Fan Data Binder "A"

marks the spot

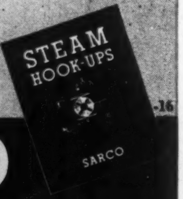
WHERE FUEL SAVINGS BEGIN

When steam traps leak—tons of coal filter through this small neck of the system every year. When they air bind, money is lost and service complaints are frequent.

Sarco Thermostatic Traps differ at this point from all others—the Sarco Bellows—never duplicated—can be tested hydrostatically up to 75 pounds on low pressure systems, and is made for service up to 200 pounds steam pressure on high pressure lines. It is powerful—yet very sensitive—and inexpensive; yet lasts for years.

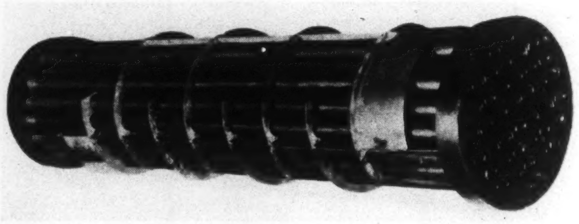
There's a Sarco Trap for every kind of steam condensation removal service.

ASK FOR THIS NEW DATA BOOK
—On your business letter-head. Shows how to hook up all types of heating, air conditioning and process equipment with suitable traps and control.



COMPLETE SYSTEMS FOR HEATING AND INDUSTRY
SARCO
THERMOSTATIC, FLOAT AND BUCKET TRAPS, REGULATORS AND HEATING SPECIALTIES
SARCO COMPANY, Inc., 183 MADISON AVENUE, NEW YORK, N. Y.
SARCO CANADA LIMITED, FEDERAL BLDG., TORONTO, ONT.

pressure. The tubes are held fast in the tube sheets by a specially prepared graphite cement. The channels at either end are constructed of steel entirely lined with rubber.



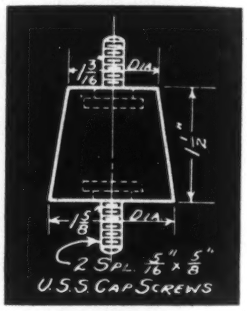
Cooling water makes a single pass through the shell side of these units while the acid solution makes a double pass inside the tubes. This special type of heat exchanger is particularly adapted for handling very corrosive liquors, including all but a few acids.—Foster Wheeler Corp., 165 Broadway, New York, N. Y.

Adds to Vibration Insulators

No. 1432—Addition to "Vibro-Insulator" line of rubber-to-metal type mountings is made of a rubber compound having an exceptionally low permanent set, according to the maker. The rubber and metal parts of this unit are bonded together by a special process of adhesion, and each insulator is provided with bolts for attaching to the equipment with which it is to be used.

The new unit is designed to carry loads either in shear or compression. When loaded in shear each mounting will carry a load of 30 lb, and when loaded in compression it will support a load of 120 lb. In either case the deflection is ⅜ in., providing for a minimum machine frequency of 925 per minute.

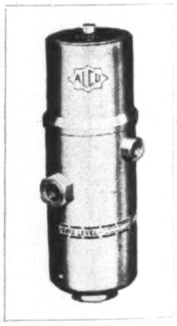
These vibration insulators are particularly useful in compression as mountings for air compressors and refrigerating units.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.



Float Switches Control Flooded Evaporators

No. 1433—Flooded type evaporators often introduce liquid level control problems which require special control equipment, according to the maker of the combination float switch and magnetic valve illustrated, which operates directly by changes in liquid level and offers a solution to many of these problems. The switch may be used as a low pressure float valve to accurately maintain the refrigerant liquid level in an evaporator, as a high pressure float valve to keep the receiver drained of liquid, or as a low level alarm.

The switch is essentially an electrical relay operated by changes in liquid level in its float chamber. It is mounted near the evaporator or condenser at the desired liquid level and the bottom outlet is connected to the bottom of the flooded unit, with the vent opening at the side of the switch connected to the unit above the liquid level. A mercury tube on the float switch is then wired in series with a magnetic stop valve in the liquid feed line.



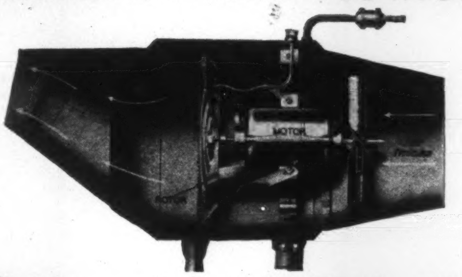
When the float chamber of the switch is empty, the circuit to the stop valve is completed to open it and permit liquid refrigerant to flow into the evaporator. When the float ball in the switch rises with the liquid level, it acts to break the electrical circuit and cause the magnetic valve to close.—Alco Valve Co., Inc., 2628 Big Bend Blvd., St. Louis, Mo.

It fits like a Glove!

FOR YOUR SPECIFIC MOTOR PROBLEM

HOLTZER-CABOT

Custom-Built MOTORS



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The HOLTZER-CABOT
ELECTRIC COMPANY
BOSTON ~ ~ ~ ~ ~ MASS.
CHICAGO · NEW YORK · PHILADELPHIA ·

Patterson Indestructo Copper Lined Hot Water Heaters

This is practically two heaters in one. The lining has a complete copper shell built inside of and reinforced by a steel shell. Thus it combines the superior strength of steel with the non-corrosive and durable qualities of copper.

All seams of Patterson Indestructo Heaters are electrically welded, forming solid permanent joints. The copper lining is welded to the extra heavy bronze reinforcements at all pipe openings, which are in turn welded solidly to the steel shell. The copper lining extends through the nozzle and manhole openings and is continuously welded to the edges.

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Indestructo Copper Lined Heaters which have been in use for more than a quarter of a century are still in fine condition. We guarantee them not to rust or cause red water.

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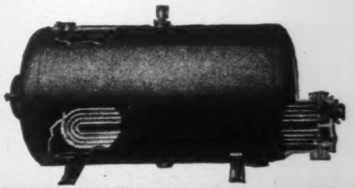

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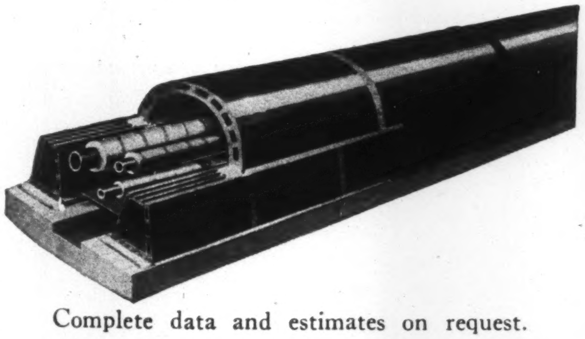

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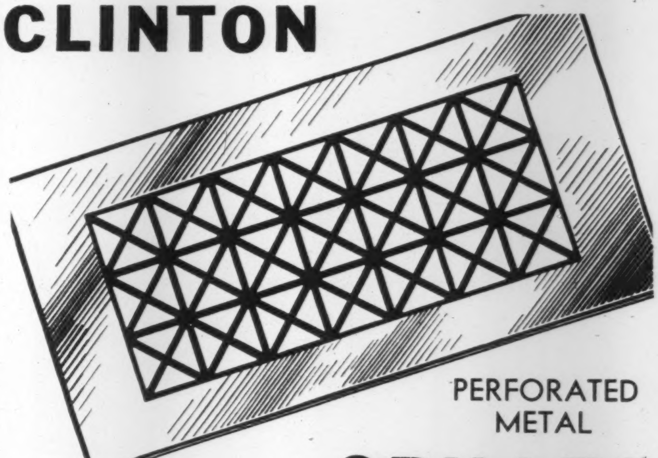

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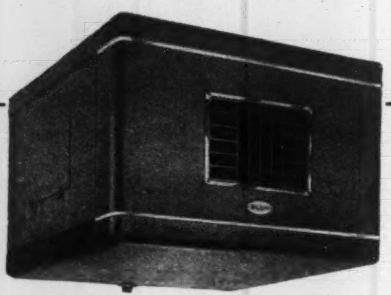

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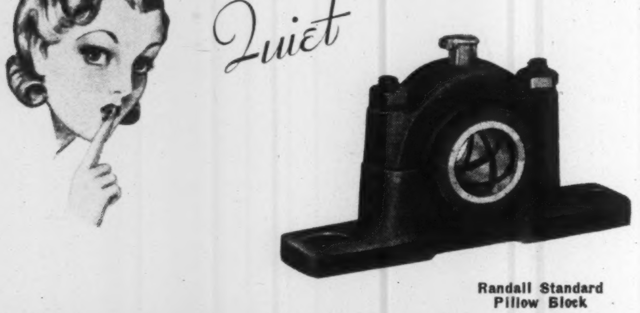

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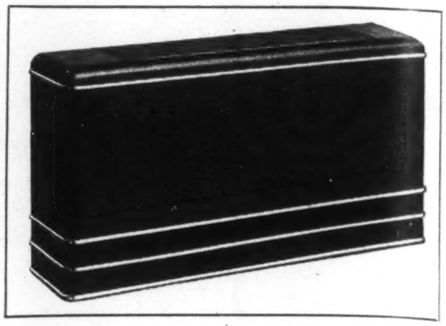
Dept. 310, 609 W. Lake St., Chicago, Ill.

Heating and Cooling Unit Introduced

No. 1434*—New "Temperator" air conditioning unit for heating and cooling was introduced at the recent heating and ventilating exposition. Designed to coincide with the modern motif of interior decoration, it has smooth flowing lines, and the mechanism and operating controls are accessible but not visible.

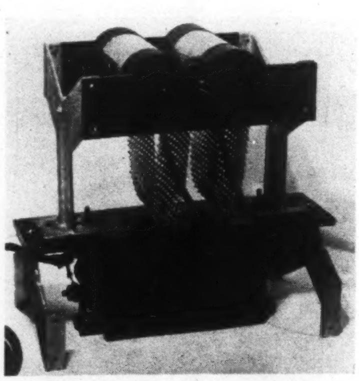


It may be installed with access to the outside air, and a uniquely designed damper operating on ball bearings and subject to either automatic or hand operation regulates the amount of outside and inside air mixed and circulated. For winter service the unit is particularly adapted for use as a part of the manufacturer's sub-atmospheric steam heating system.

To change from winter to summer service requires only the turning of a valve which switches the system from contact to the boiler to connection with a chilled water supply, the same piping which carried the steam and condensate now carrying the cooling liquid. A special feature of the unit is the heating and cooling coil which is arranged to be of three times greater capacity in cooling service than when used for heating. Three fan speeds are available.—C. A. Dunham Co., 450 E. Ohio St., Chicago, Ill.

Duct Type Ionizer Announced

No. 1435**—A new duct type ionizer for use with ventilating and air conditioning systems is being introduced. It is designed to be installed in the return intake duct or in the fan chamber, and to destroy odors and "staleness" of the air by creating ozone. According to the maker, it is possible by the use of this unit to reduce the quantity of air taken from the outside for ventilating purposes.—Lowell Air Conditioning Corp., Otis Bldg., Philadelphia, Pa.



Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 142. If you write direct to the manufacturer, describe carefully what literature you want, as the reference numbers given are for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING

No. 2676. AIR CONDITIONING AND HEATING: Carrier Corp., Syracuse, N. Y. 16 p. miniature catalog of equipment for air conditioning, refrigeration, and unit heating, covering a wide range for commercial, industrial and residential service. Descriptive and dimensional data are given.

No. 2677. AIR CONDITIONING AND HEATING: Trane Co., La Crosse, Wis. Issue of "Weather Magic," Vol. 1, No. 11, describing various heating and air conditioning installations using the publisher's equipment in a bottling plant, a clothing store, fire department headquarters, and others.

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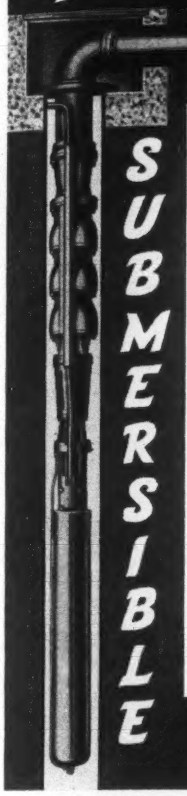

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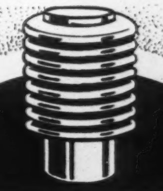

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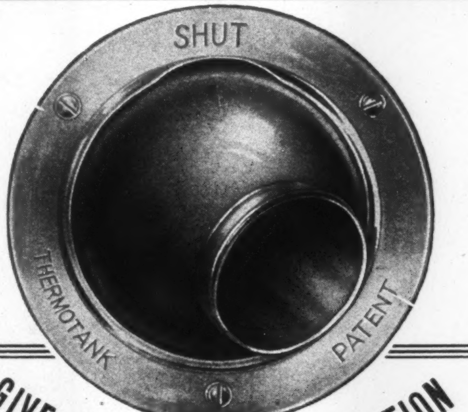

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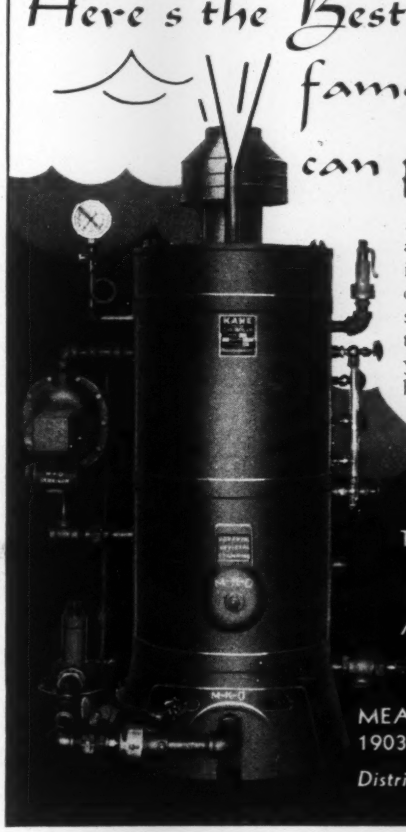

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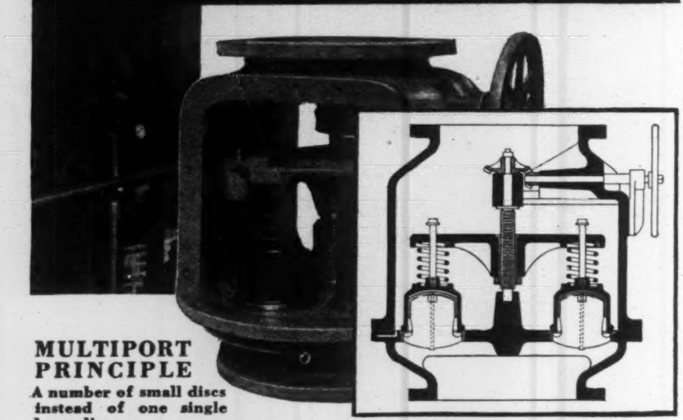

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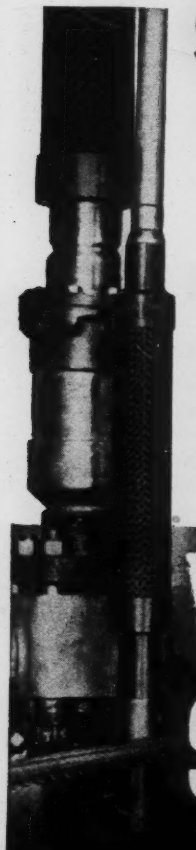

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No. 2679. AIR FILTERS: Independent Air Filter Co., 228 N. La Salle St., Chicago, Ill. 8 p. bulletin on the "Kompak" dry fabric air filter, combining the principles of large area, low velocity, and renewable medium. Mechanical features are carefully described and illustrated and engineering data are given.

No. 2680. AIR FILTERS: Northern Blower Co., 6409 Barberton Ave., Cleveland, Ohio. 4 p. bulletin on "Norblo" square type air filters designed for continuous automatic operation in industrial dust collecting service. Detailed drawings and dimension data are presented.

No. 2681. ALLOYS: Bridgeport Brass Co., E. Main St., Bridgeport, Conn. 80 p. technical handbook covering physical properties and applications of four high strength silicon bronzes sold under the trade name "Duronze Alloys." In addition to many detailed tables and curves giving physical characteristics and applications, the manual gives tables on corrosion resistance, machinability data, welding practices and weight tables, and is, in effect, a metallurgical textbook on silicon bronze.

No. 2682. BEARINGS, BUSHINGS, AND BAR BRONZE: Johnson Bronze Co., S. Mill St., New Castle, Pa. 64 p. catalog giving complete information on sleeve type bearings, featuring a simplified catalog indexing to facilitate selection of bearing types and sizes. Information is given on bronze bearing alloys, tolerance, and a large range of sizes which are listed progressively. Special sections are included on oil grooving, flanged bearings and bushings, a decimal equivalent chart, and a listing of sales offices and warehouses.

No. 2683. BLOWER WHEELS: Torrington Mfg. Co., 70 Franklin St., Torrington, Conn. 4 p. technical bulletin on pressed steel blower wheels, listing 12 sizes from 3 to 9 in. diameter in single and double widths, giving dimensions for both wheels and housing scrolls. Capacity ratings are also available.

No. 2684. BOILER FEEDERS AND CUT-OFFS: McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill. 4 p. condensed catalog and price list of boiler feeders, low water cut-offs, and combined feeders and cut-offs, illustrating and briefly describing the various types. Also, a leaflet describing boiler water level control for hand fired and automatically fired boilers.

No. 2685. CABLE CONNECTORS: Tweco Products Co., 111 W. Third St., Wichita, Kan. Data sheet describing cable connectors for electric welding service and electrode holders.

No. 2686. CIRCUIT BREAKERS: General Electric Co., 1 River Rd., Schenectady, N. Y. 12 p. bulletin on air circuit breakers for protecting low voltage electric circuits in central station, industrial and building equipment service.

No. 2687. CONVECTORS: Young Radiator Co., 709 Mead St., Racine, Wis. 4 p. engineering data bulletin on convectors for forced hot water heating systems, describing and illustrating features, giving complete capacity tables and information on ratings; also, a leaflet featuring these convectors.

No. 2688. COPPER STEEL: Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh, Pa. 16 p. booklet on copper steel entitled "A Little Copper in Steel Gives a Lot of Protection," featuring results of the latest A.S.T.M. experiment on atmospheric corrosion resistance of various grades of steel and iron. A useful feature is a list of fabricated products for which "U. S. S." copper steel is particularly adapted.

No. 2689. COPPER TUBES AND FITTINGS: American Brass Co., 414 Meadow St., Waterbury, Conn. 28 p. booklet on "Anaconda" copper tubes and fittings for heating lines, giving information on gages, types and tempers of tubes; wrought and cast fittings and methods of assembly; means of providing for expansion and contraction; and comparative heat losses. One chapter suggests the procedure for sizing copper tubes and gives an example.

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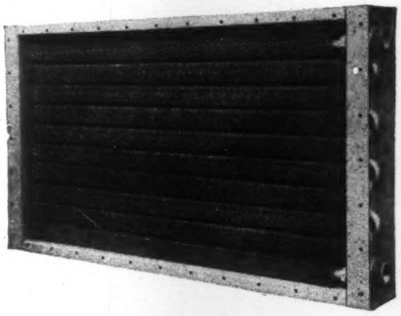

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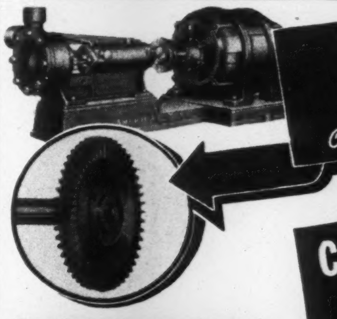

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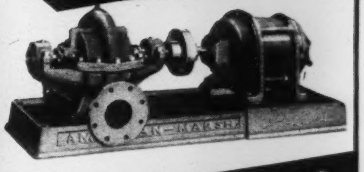

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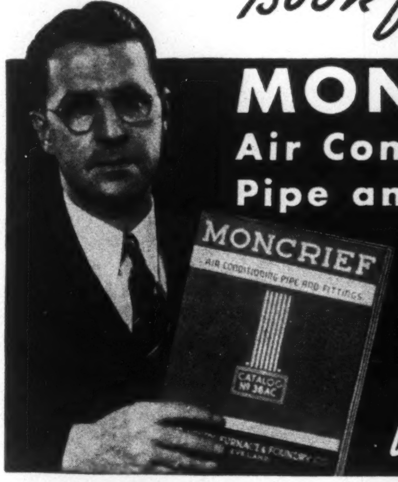
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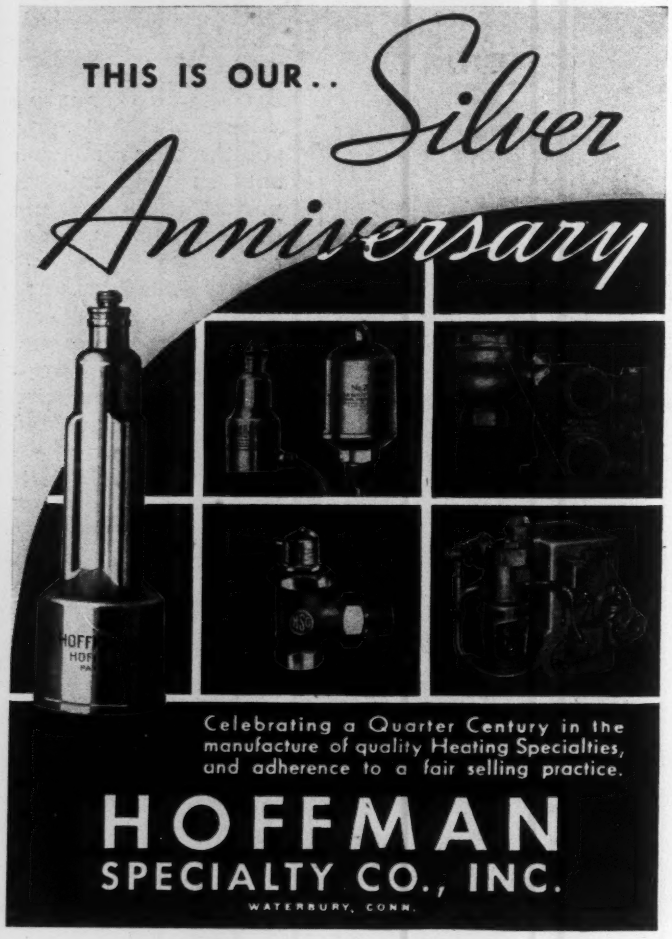

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No. 2690. DEHUMIDIFIERS: Carrier Corp., Syracuse, N. Y. 4 p. research bulletin of The Producers' Council, Inc., on the silica gel dehydrator, discussing independent control of temperature and humidity, describing the process and equipment, advantages of the method, and various industrial and comfort air conditioning applications.

No. 2691. DUST CONTROL: W. W. Sly Mfg. Co., 4700 Train Ave., Cleveland, Ohio. 8 p. booklet "Picking Profits Out of the Air," by F. A. Ebeling, briefly discussing industrial dust control.

No. 2692. FLEXIBLE METAL HOSE: Packless Metal Products Corp., 37-14 29th St., Long Island City, N. Y. Engineering data booklet on seamless flexible metal hose, detachable self-sealing couplings, self-flaring tube couplings, and copper tubing with detailed descriptions of the various products and information and illustrations on applications and uses.

No. 2693. GAS ENGINES: Worthington Pump & Machinery Corp., Harrison, N. J. 8 p. bulletin describing vertical four cycle gas engines for natural, manufactured, sewage or refinery gas, describing features and uses—which include air and gas compressor drives, refrigeration and ice plants, etc.

No. 2694. GRILLES: Tuttle & Bailey, Inc., Corbin Ave., New Britain, Conn. 12 p. booklet presenting engineering data and selection system for "Airline," "Flexair" and "Hivelair" grilles for air conditioning installations, describing how to determine proper sizes and constructions to satisfy various conditions. Procedure is fully explained and a series of charts and tables presented.

No. 2695. HUMIDIFIERS. Thermal Units Mfg. Co., 70 Britannia St., Meriden, Conn. 4 p. bulletin on automatic humidifiers for use with steam, hot water and vapor heating systems in factories, shops, offices and homes. The unit and its installation is described and technical data presented.

No. 2696. METHYL CHLORIDE: E. I. du Pont de Nemours & Co., R. & H. Chemicals Dept., Wilmington, Del. 12 p. reprint "Methyl Chloride—A Practical Refrigerant Measured by the Theoretical Ideal," by E. W. McGovern, giving a detailed technical discussion of this refrigerant and its properties.

No. 2697. MOTORS: Century Electric Co., 1806 Pine St., St. Louis, Mo. 4 p. bulletin on automatic start induction polyphase motors, giving complete information on construction. Also, a sheet listing sales offices and warehouses of this company.

No. 2698. MOTORS: Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill. 8 p. bulletin on direct current motors supplied in sizes up to 200 hp with a variety of mechanical modifications for both high and low voltage operation. Construction details are fully described and illustrated.

No. 2699. MOTORS AND CONTROL: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 12 p. bulletin entitled "Electric Drive Selector and Hints on Maintenance," devoted to motors, control and circuit protection, including illustrated tables showing how to select the motor for various applications, how to apply manual and magnetic control and giving ten hints on "preventative maintenance."

No. 2700. POWER SHEARS: Niagara Machine & Tool Wks., 637-697 Northland Ave., Buffalo, N. Y. 12 p. bulletin on power squaring shears, describing construction features in detail and giving capacity chart.

No. 2701. PREFABRICATED DUCTS: Lamneck Products, Inc., 416-436 Dublin Ave., Columbus, Ohio. 12 p. catalog showing photographs and giving descriptions, sizes and prices for this company's complete simplified system of prefabricated duct and fittings for forced air and air conditioning installations. Also illustrated is a "take-off" pad to simplify estimating and guard against errors and omissions.

No. 2702. PUMPS: Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill. 4 p. bulletin announcing new line of duplex self-oiling power pumps for pumping water, oil or other free flowing liquids in quantities up to 187 gpm and at pressures up to 1000 lb per sq in.

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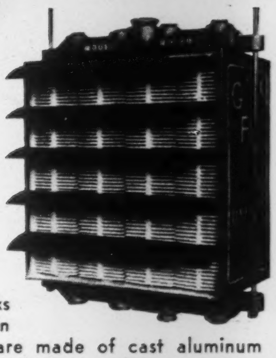

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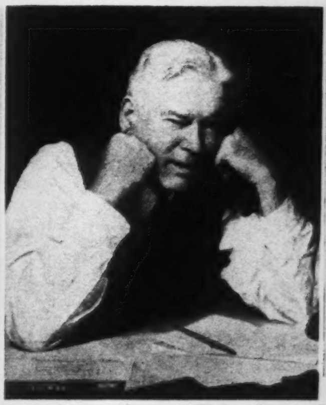

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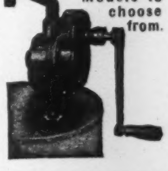
Easy to turn — fast action. Ideal for pumping from drums, vats, etc. 14 Models to choose from.



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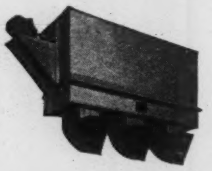

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Temperature Records

- **You know how important temperature records are for test or installation work. But do you know about Practical recording thermometers? Endorsed by servicemen and engineers. Used in air conditioning, refrigeration, and heating. Unusually low priced. Sturdily built. Guaranteed. Give dependable records. Completely portable and self-contained. 7½ in. high. Get complete information.**

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PRACTICAL *Recording Thermometer*

BENDING BRAKES **WHITNEY-JENSEN** METAL TOOLS

No. 75 DUPLEX ROLLING MACHINE

- ROLL Pittsburgh locks, drive cleats, etc. far cheaper and faster than you can fold them. The new Whitney-Jensen No. 75 DUPLEX Rolling Machine has TWO sets of rolls which can be set up for either identical or different rolling operations. A 1 h. p. motor, concealed in the base, permits rolling of 18 ga. sheets at 38 ft. per min. This machine is strong, rigid, neatly covered, and durably constructed throughout.

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WHITNEY METAL TOOL CO. • 180 Forbes Street, Rockford, Illinois

DUPLEX ROLLING MACHINE
No. 75

FOR YOUR CONVENIENCE

Heating, Piping and Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [3-38]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

1419	1420	1421	1422	1423	1424	1425
1426	1427	1428	1429	1430	1431	1432
1433	1434	1435				
2676	2677	2678	2679	2680	2681	2682
2683	2684	2685	2686	2687	2688	2689
2690	2691	2692	2693	2694	2695	2696
2697	2698	2699	2700	2701	2702	2703
2704	2705	2706	2707	2708	2709	2710
2711	2712					

Name.................................... Title..............

Company ....

Address ....

City.................................... State..............

No. 2703. PUMPS: Goulds Pumps, Inc., Fall St., Seneca Falls, N. Y. 8 p. bulletin on single stage ball bearing centrifugal pumps for many industrial uses, describing features and giving capacity tables and specifications, and dimensions.

No. 2704. REFRIGERANT CONTROL: Alco Valve Co., Inc., 2628 Big Bend Blvd., St. Louis, Mo. 4 p. engineering data sheet form designed to provide the refrigeration and air conditioning industries with an easy means of obtaining engineering application recommendations from the company's engineering division. Sections are included for compressor or condensing unit data, for evaporator data, and for liquid and suction line information. Other questions are asked to determine such facts as the type of controls in use and the manner in which they are applied, and ample space is provided in the form for sketches or drawings.

No. 2705. REGULATORS: Spence Engineering Co., Inc., 32 Grant St., Walden, N. Y. 20 p. condensed catalog of regulators with detailed descriptions, illustrations and tables on the many types, including main valves, temperature control, combined temperature and pressure regulators, liquid level control, electric control, desuperheaters, combustion control, direct acting valves, etc. A section of engineering data is included.

No. 2706. STEAM TRAPS: Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa. 12 p. bulletin on impulse steam traps, giving complete information on principle and construction, a section on selection, diagrams of typical installations, and information on capacities, prices, weights and dimensions.

No. 2707. UNIT COOLERS: Thermal Units Mfg. Co., 70 Britannia St., Meriden, Conn. 8 p. data bulletin on unit coolers for use in air conditioning, refrigeration, and dehumidifying in process work, describing and illustrating the equipment, giving connection diagrams, and capacity tables.

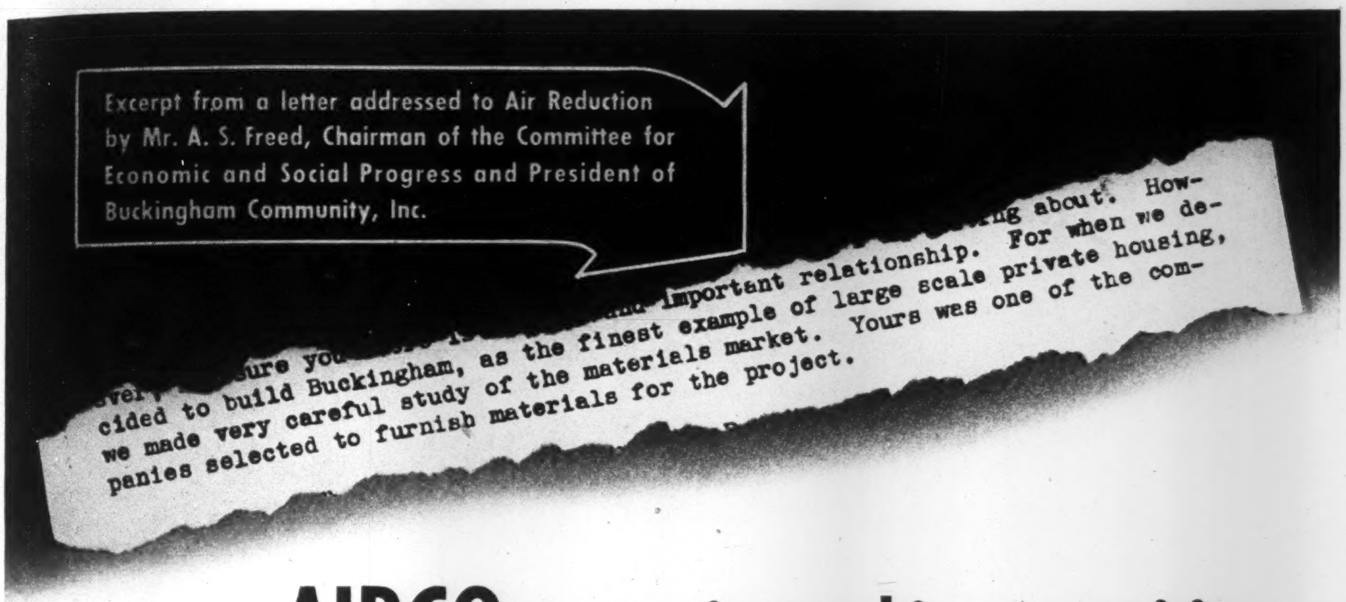
No. 2708. UNIT HEATERS: Thermal Units Mfg. Co., 70 Britannia St., Meriden, Conn. 8 p. engineering data bulletin on unit heaters, giving information on design and construction, presenting capacity table, and explaining selection. A section is also included on blast coils and their selection.

No. 2709. UNIT HEATERS: Young Radiator Co., 709 Mead St., Racine, Wis. 4 p. bulletin on recently introduced unit heater describing and illustrating features in detail and giving capacity table. Also, a leaflet featuring these units.

No. 2710. VALVES: Homestead Valve Mfg. Co., P. O. Box H, Coraopolis, Pa. 6 p. leaflet featuring lift plug valves for severe pressure and temperature conditions, briefly describing them and listing various industrial uses.

No. 2711. WATER COOLERS: Foster Wheeler Corp., 165 Broadway, New York, N. Y. Issue of "Heat Engineering," Vol. 13, No. 1, including information on "Freon" water coolers for use in commercial cooling and air conditioning systems.

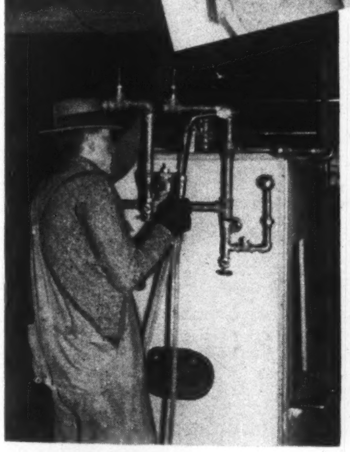
No. 2712. WATER COOLERS: Patterson-Kelley Co., Inc., East Stroudsburg, Pa. 8 p. data bulletin on "Freon" water coolers with information on construction and applications and capacity tables for various cooling ranges. Typical installations are illustrated.



Excerpt from a letter addressed to Air Reduction by Mr. A. S. Freed, Chairman of the Committee for Economic and Social Progress and President of Buckingham Community, Inc.

ng about. How-
ever, ure you important relationship. For when we de-
cided to build Buckingham, as the finest example of large scale private housing,
we made very careful study of the materials market. Yours was one of the com-
panies selected to furnish materials for the project.

AIRCO appreciates this recognition by the builders of Buckingham



Typical views of the domestic water piping being installed in the 62 buildings of the Buckingham housing project. WAL-SEAL Threadless Bronze Valves and Fittings are being used practically throughout, assuring permanently leakproof water systems. The brazing of these fittings, totaling approximately 80,000 joints, is being done entirely with AIRCO Oxygen and Acetylene and AIRCO-DB Apparatus.

AIRCO considers it a real privilege to participate, through the use of its products, in this valuable and far-reaching contribution to the progress of housing in America—the Buckingham project.

And AIRCO also values this additional confirmation of the established merit of its products, because selection was made after "*very careful study of the materials market.*"

AIRCO Gases, and AIRCO Welding and Cutting Apparatus and Supplies, *thrive on comparisons*, for their exceptional quality, and their many time-labor-money saving features, make them stand out in any company.

In addition, there is the service that goes with AIRCO products—the cooperation of a trained and experienced engineering staff, available to all customers, for instruction in how to get the maximum benefit from the use of AIRCO products, and for solving special welding and cutting problems—*a service worthy of the name.*

AIR REDUCTION
SALES COMPANY
General Offices: 60 East 42nd Street
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THE NATION-WIDE WELDING AND CUTTING SUPPLY SERVICE
OFFICES and DISTRIBUTING STATIONS in PRINCIPAL CITIES

Anything and Everything for **GAS and ELECTRIC ARC WELDING and GAS CUTTING**

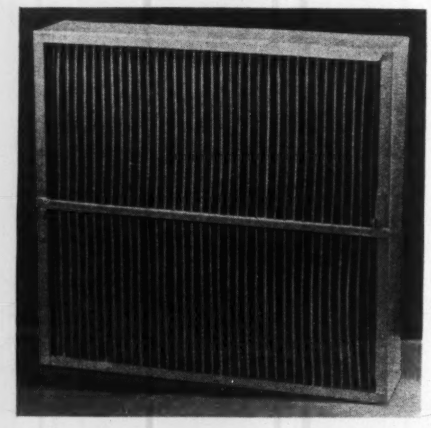
Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 142.

Air Filter Is Flame Resistant

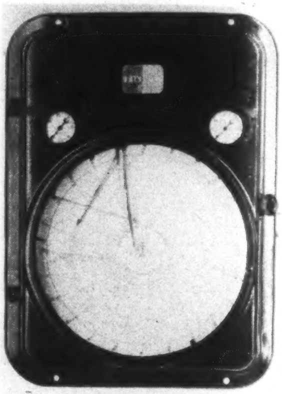
No. 1436—New dry type "Wire-Klad" air filter has the feature of flame resistance, fulfilling provisions of Section 150 of the National Board of Fire Underwriters, Pamphlet No. 90, according to the maker.

The descriptive name refers to the wire mesh reinforcement of the fins. The fin construction affords large filtering area in relatively small space, it is stated. Several kinds of filtering media to suit varying conditions are available, the most usual being cotton or a wool felt-like material known as "Feltex." Cleaning is practical with either air pressure or vacuum. If exposure to oil or greasy substances makes cleaning with a solvent necessary, the wire reinforced filter insert can be lifted from the frame. Standard and special sizes are available.—Staynew Filter Corp., 25 Leighton Ave., Rochester, N. Y.



New Reset Free Vane Controller Announced

No. 1437—New reset free vane controllers are adaptable to various types of continuous processes, which involve the control of such variables as temperature, pressure, vacuum, flow, and liquid level. In many temperature control processes, for example, there are differences in respect to the time required for a change of temperature in the system, when the cooling or heating medium is added through the control valve. In providing for a wide throttling range with automatic reset for point control, these instruments are especially suited for applications of this type, says the maker.



Thus, with these controllers, any load change, accompanied by a movement of the pen away from the control point, produces a change in the controlled air pressure of sufficient value to give the diaphragm control valve the required opening to bring the variable back to the control point. The design of the reset operating mechanism makes it possible to obtain this change automatically, at a rate that corresponds to that required by the particular process being controlled.

These instruments operate on the basic free vane principle of pneumatic control. This system consists of a thin vane, floating between two opposing small jets of air, which throttles the discharge from the jets by passing between them without actually coming in contact with the nozzle surface. Thus, the measuring element of the instrument is not restrained.—Bristol Co., Platts Bridge, Waterbury, Conn.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

No. 5 of a Series of Curtis Advanced Engineering Features.

CURTIS Cleanable Shell and Copper Tube Condensers Increase Efficiency....

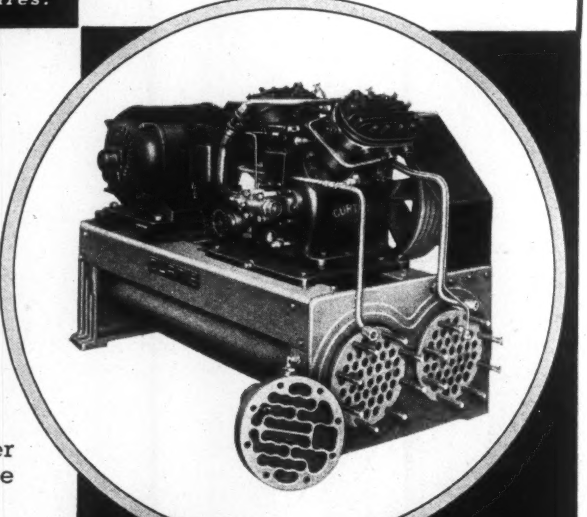
● The Curtis line of shell and tube condensers makes tube cleaning an easy matter. This type of condenser is particularly desirable where the water supply contains much lime or mineral matter. When used in connection with water towers, shell and tube condensers materially reduce pumping costs.

Curtis offers seven models with shell and tube condensers, from 3 to 30 H.P. The complete Curtis line includes 86 models from 1/6 to 30 H.P., air and water cooled—using both counterflow and shell and tube type condensers.

There is a Curtis condensing unit for every refrigeration and air conditioning need. Throughout the world, in thousands of installations, the refinements of Curtis engineering and manufacturing standards are delivering economical, trouble-free performance.

Write to Curtis for complete information.

15 h.p. unit with head of condenser shell removed showing interior tube construction.



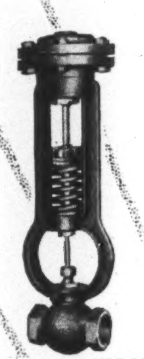
CURTIS

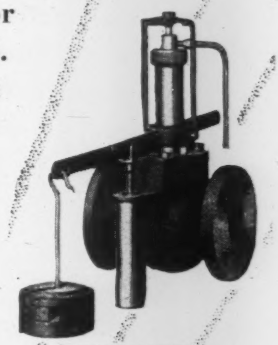
"Builders of Condensing Units Since 1922"

—for every air conditioning and refrigerating requirement.

CURTIS REFRIGERATING MACHINE CO.
Division of Curtis Manufacturing Co.
1950 KIENLEN AVENUE ST. LOUIS, MO.

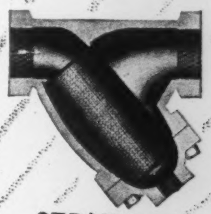
AUTOMATIC VALVE SPECIALTIES FOR MODERN POWER, HEATING, AND INDUSTRIAL PLANTS


PUMP GOVERNOR


PRESSURE REGULATOR

THE DAVIS REGULATOR COMPANY offers a most complete line of Automatic Valve Specialties for modern Power . . . Heating . . . and Industrial Plants. These specialties are designed to meet present day requirements and are ruggedly constructed to give long satisfactory service free from maintenance nuisance and expense. PRESSURE REGULATORS to meet the most critical demands for all pressure and flow conditions. PUMP GOVERNORS, diaphragm and piston actuated, spring or weight loaded, both constant, differential and vacuum types. STOP AND CHECK VALVES with internal and external dash pot for pressures up to 1500 lbs. STRAINERS, self-cleaning and basket types, for both pressure and suction lines. BACK PRESSURE VALVES that seat tight with patented internal construction that will not stick. MOTOR OPERATED VALVES in variety of types for electrical control of flow conditions in automatic heating and air conditioning systems. These as well as numerous other Automatic Valve Specialties are fully illustrated and described in bulletins which will be sent on request.

STOP & CHECK VALVE


STRAINER

DAVIS REGULATOR CO.
2546 S. Washtenaw Ave., Chicago, Ill.

BACK PRESSURE VALVES

DAVIS VALVES

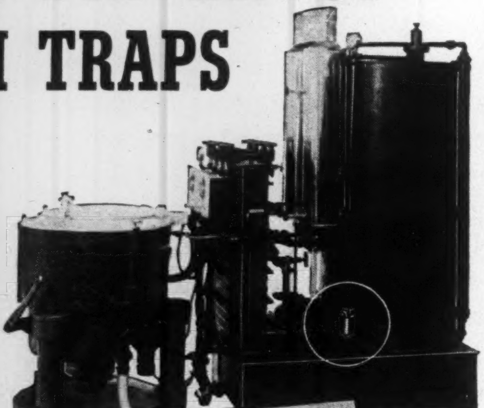
MOTOR OPERATED VALVE

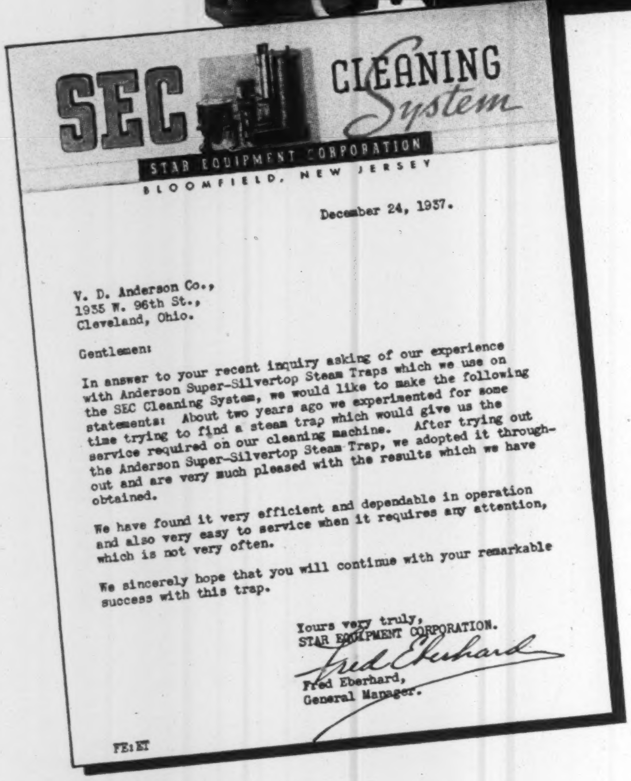
DAVIS

PRESSURE REGULATORS · STOP AND CHECK VALVES · FLOAT VALVES · RELIEF VALVES · MOTOR OPERATED VALVES · SOLENOID VALVES · STRAINERS · PUMP GOVERNORS · BUTTERFLY VALVES · FLUID LEVEL CONTROLLERS · BACK PRESSURE VALVES

SPECIAL CONTROL PROBLEMS SOLICITED

How SEC *decided on*
SUPER-SILVERTOP
STEAM TRAPS





SEC CLEANING System
STAR EQUIPMENT CORPORATION
BLOOMFIELD, NEW JERSEY

December 24, 1937.

V. D. Anderson Co.,
1935 W. 96th St.,
Cleveland, Ohio.

Gentlemen:

In answer to your recent inquiry asking of our experience with Anderson Super-Silvertop Steam Traps which we use on the SEC Cleaning System, we would like to make the following statements: About two years ago we experimented for some time trying to find a steam trap which would give us the service required on our cleaning machine. After trying out the Anderson Super-Silvertop Steam Trap, we adopted it throughout and are very much pleased with the results which we have obtained.

We have found it very efficient and dependable in operation and also very easy to service when it requires any attention, which is not very often.

We sincerely hope that you will continue with your remarkable success with this trap.

Yours very truly,
STAR EQUIPMENT CORPORATION.
Fred Eberhard
Fred Eberhard,
General Manager.

FE:ET

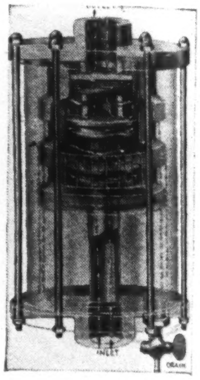
SUPER-SILVERTOP
STEAM TRAP

After thorough investigation and tests Star Equipment Corporation decided on Anderson Super-Silvertop traps because of their greater efficiency and dependability. Other purchasers like the choice of straight-in-line or elbow connection. The saving in fittings and labor, greater capacity and guided bucket are other features that make Anderson Super-Silvertops the choice of thousands of steam trap users. Get the facts about Super-Silvertop, write today.

THE V. D. ANDERSON COMPANY
1935 WEST 96TH STREET · CLEVELAND, OHIO

New Unit Cleans Gas, Steam, Air

No. 1438**—New "Hager" separator has been designed to remove water, oil, dirt, etc., from compressed air, gas, and steam. It measures only 10½ in. high by 6 in. in diameter and weighs 15½ lb. Pressure of the element passing through separator provides the cleaning action, obtained by linear deflection, jetting, centrifugal force, capillary attraction and sudden expansion.



Mounted one above the other are three internal vaned units through which the air, gas or steam must travel. Each of these units sets up a whirling movement to throw moisture and dirt outward from the center. The flow is caught by additional sets of vanes curved in the opposite direction and secured to overlapping sleeves inside the housing. The reversal following the centrifugal action causes the moisture and dirt to strike the inner surface of the cups from where they drop to a collection chamber.—Textite Corp., 2110 Roscoe St., Chicago, Ill.

Oxy-Acetylene Hose in Single Unit

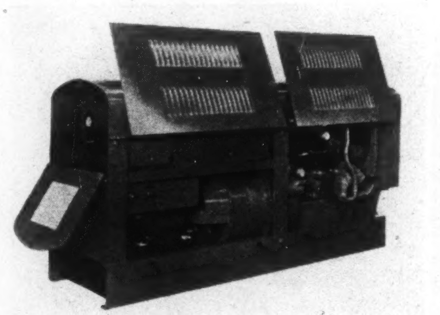
No. 1439—A new oxy-acetylene hose ("Duoweld") consists of two strands of ¼ in., two braid hose with corrugated cover molded together as a single unit. The cover on one strand is red, and the other is green, to aid the operator in identifying the acetylene from the oxygen line. Advantages claimed for this dual construction are that it prevents the two lengths of hose from becoming tangled with each other, eliminates kinking, and is less apt to snag on surrounding objects.

THE B. F. GOODRICH CO.
DUOWELD

This hose is offered in 12½, 25, and 50 ft lengths. Each length is separated and secured with metal ferrules about a foot and a half from the ends for easy attachment to equipment.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Arc Welder Driven by Diesel

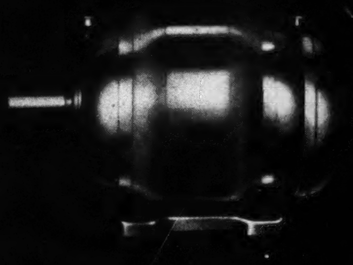
No. 1440—A new diesel engine, which (according to the maker) compares favorably with gasoline engines in simplicity, weight and cost, as well as operating speed, has been adopted for driving arc welding generators. At full load operation, it uses only 1.5 gal per hr of fuel oil. In many cases, total savings, including such items as transportation of fuel, loss, etc., are as high as 40c per hr, it is said.



Maximum efficiency and service economy of the engine are assured by a new principle embodying patented combustion chambers. By accelerating turbulence of the fuel and air mixture, this affords more complete combustion, increasing efficiency, and minimizes smoke and noise. Also, the position of this combustion chamber, relative to the piston, provides uniformly distributed pressure on the piston.

The arc welding generator used on the new diesel engine driven welding machine, is the 300 ampere "Shield-Arc SAE"

THE *Latest* DEVELOPMENT IN ELECTRIC MOTORS



THE NEW BALDOR *Streamcooled* MOTORS

A complete New Line of totally enclosed motors, fully protected against dust, dirt and splashing and

EFFECTIVELY COOLED

by means of an outer fan which forces cool air across the entire exterior of the motor frame.

Single Phase, 1—7½ HP; Polyphase, 1—15 HP; DC, 1—3 HP.

BALDOR
A BETTER MOTOR

BALDOR ELECTRIC CO. ST. LOUIS

Another NOTABLE NAME ADDED TO AN IMPRESSIVE ROSTER

CLARAGE FAN COMPANY

Now an...

AUDITORIUM LICENSEE

CLARAGE FAN COMPANY—well known for more than a quarter of a century as builders of air handling equipment—joins with the other notable concerns listed below, as a Licensee under Auditorium Patents. It may now install licensed Central Station air conditioning systems or manufacture units which incorporate the many advantages of Auditorium inventions or grant permissions to others to install licensed systems, thus providing the benefit and economies of Auditorium Systems to its customers.

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GENERAL ELECTRIC COMPANY—Schenectady, N. Y.
J. O. ROSS ENGINEERING CORP.—New York, N. Y.
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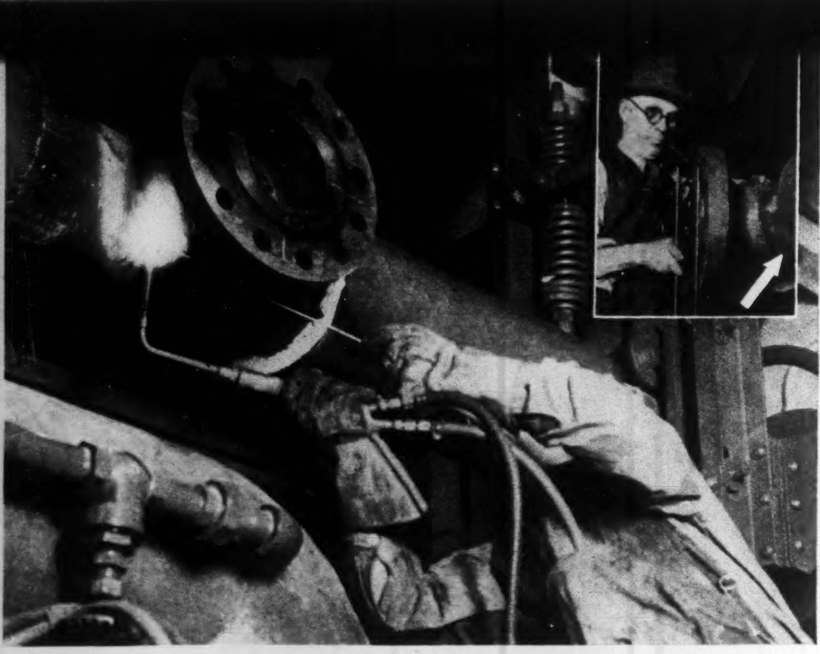
YORK ICE MACHINERY CORPORATION—York, Pa.

Any of the Licensees above, their Branch Offices, Distributors, or Dealers can furnish information and diagrams describing Auditorium Systems. For details of the Auditorium Plan you may write direct to

AUDITORIUM CONDITIONING CORPORATION
New York Office — 17 East 42nd St., New York



For Maintenance—
BONNEY WELDOLETS·THREDOLETS

ON maintenance work, Bonney WeldOlets and ThredOlets prove their economy better than on any other type of job. Pictured above is a 6" WeldOlet with flange being attached an existing 8" boiler feed line. It would have required ap- oximately 8 hours to remove the 8" line, cut, thread, insert a e and replace it.

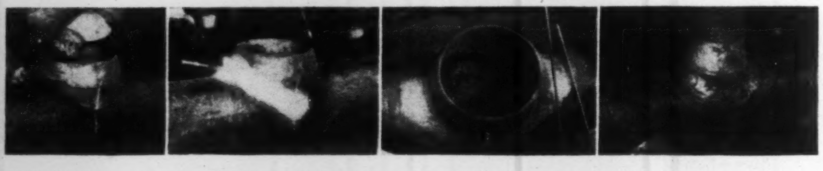
With the Bonney WeldOlet the main pipe stayed in position. ie fitting was simply welded into place at the desired position id the hole cut in the main pipe, after the fitting was installed. Result—an absolutely, leak-proof joint of full pipe strength ith turbulence and friction reduced to a minimum and savings installation costs that run as high as 43%. The small illustra- on shows a square placed on the neck of the flange after in- allation. No warping or distortion was evident.

WeldOlets and ThredOlets with outlets from 1/4" to 12" are ailable for all standard pipe sizes, in size-to-size or reducing es. Carried in stock of drop-forged steel. For special ap- ications they are also furnished in Wrought Iron, Toncan Iron, ass, Everdur, Monel, Stainless Steel, in fact any metal that can e forged.

Use them at a saving on your next maintenance job. In the eantime write for Bulletin WT23 telling How, When, Where id Why to use them.

The names "WeldOlets" and "ThredOlets" are Bonney trademarks registered in the United States Patent Office. Full patent coverage has been granted in the U. S. and foreign countries.

They are easily installed!



Weldolets and redolets are ckly and easily alled. Select the ition of the outlet where on the n pipe, mark cen- lines and tack the ng into position.

Then weld by electric-arc or oxy-acetylene method. A leak-proof joint of full pipe strength is obtained.

On 2" outlets or larger, the button is removed after installation. A full inspection of the inside of the joint is possible when WeldOlets and ThredOlets are used.

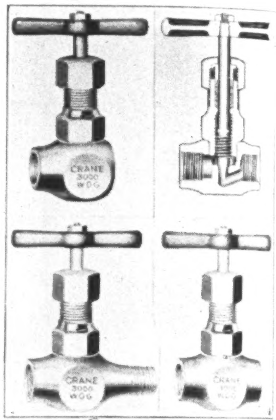
A simple Vee weld is used for attaching the branch when WeldOlets are used. If ThredOlets are used, the branch is screwed into position.

ONNEY FORGE & TOOL WORKS-Allentown, Pa.
WELDOLETS·THREDOLETS
. . . Welded Outlets for Piping . . .
Stocked by Leading Distributors

unit equipped with dual-continuous control, a method of welding current control which provides the right size and type of arc. Features of this generator include continuous voltage control; continuous current control; extra wide range; independent excitation; laminated magnetic circuit; high capacity; high efficiency; cool operation; and all purpose meter.—Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

Bar Stock Valves Have Many Uses

No. 1441—Three new bar stock valves which have uses in almost every industry are being introduced. These small 3000 lb. plug type disc, globe and angle valves are called bar stock valves because their bodies and bonnets are made from solid bar stock. They are used for connections on orifice meters, regulator leads, bypasses, gages, expansion valves on ammonia lines, and many similar services where accurate regulation of flow is desired or where parts of measuring instruments must be protected against the sudden release of high pressures.

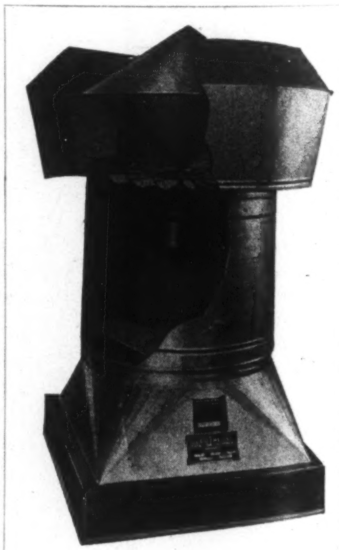


All of these valves may be packed when wide open when under pressure. They are furnished either in steel, "Exelloy" or 18-8 chrome nickel alloy. The "Exelloy" valves are particularly suitable for handling oil or gas containing sulphur compounds or for installations where steel valves do not have sufficient resistance to atmospheric corrosion, says the maker. The 18-8 alloy valves are especially suited for oil and gasoline containing hydrogen sulphide or sulphur dioxide when moisture is apt to be present.

The globe valve is made with male and female ends in sizes ⅛ to ¾ in. inclusive, and is considered especially convenient where it is desirable to screw the valve directly into equipment having a female opening, thus eliminating the need for a nipple. Sizes ⅛ in. and 1 in. also are being added to the maker's line, which now includes the globe and angle patterns with female ends in sizes ⅛ to 1 in. inclusive, and the new globe pattern with male and female ends mentioned.—Crane Co., 836 S. Michigan Ave., Chicago, Ill.

Fan Roof Ventilator Announced

No. 1442—New fan roof ventilator has been developed to meet the demand for positive, assured roof ventilation under every atmospheric condition. Special features in the design have reduced the resistance to air flow to a minimum and the entire unit presents an attractive outer appearance, the maker states.

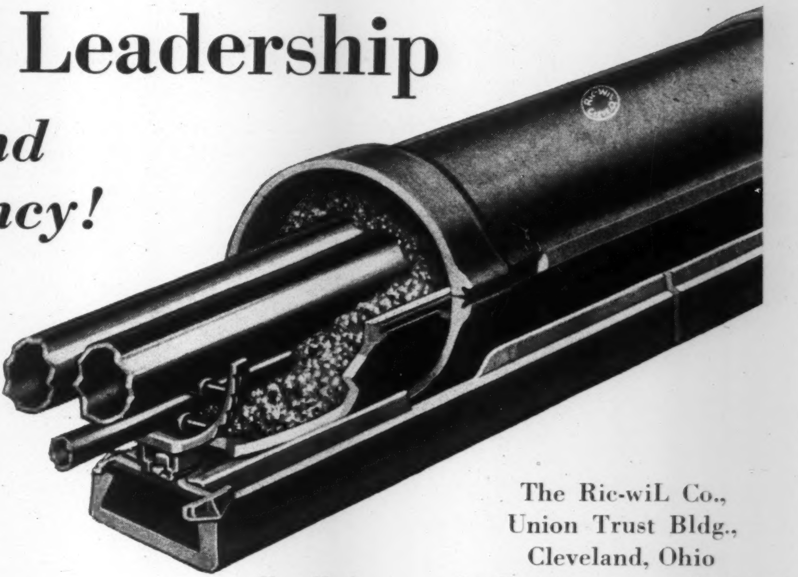


The fan used has a non-overloading power characteristic, and cannot overload the motor under varying draft and pressure conditions. Motor is totally enclosed, ball bearing, designed for vertical operation. Fan ring and motor are mounted on vibration dampeners to eliminate noise and vibration.

RIC-WIL Conduit Has Earned its Leadership

in Underground Steam Efficiency!

- **By Superiority of Design!**
- **By Total Footage Installed!**
- **By Comparative Test Data!**



Stack up the Ric-wiL record against that of any other conduit on the market—and you get just one answer! The thoroughly demonstrated, economical method of keeping *your* underground steam lines tight, dry, and over 90% efficient, is to house them in a Ric-wiL Tile or Cast Iron System, insulated with famous Ric-wiL Dry-paC. Competent service, nation-wide, on design, manufacture and installation. Write for Catalog showing all types.

The Ric-wiL Co.,
Union Trust Bldg.,
Cleveland, Ohio

New York San Francisco Chicago

Agents in Principal Cities

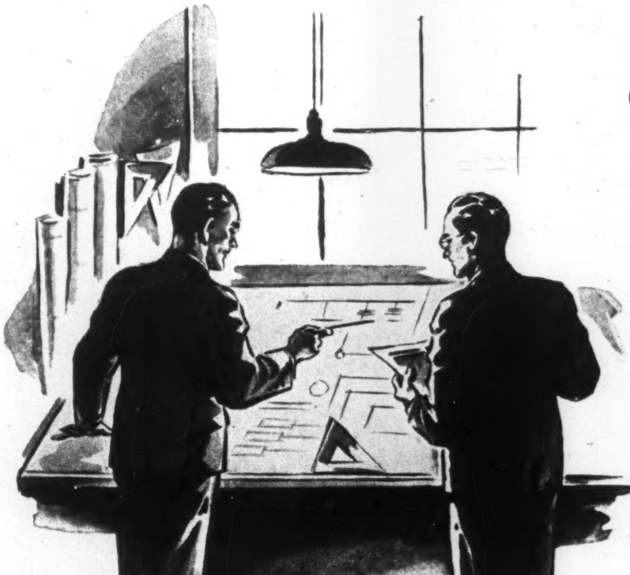
REGISTERED IN U. S. PATENT OFFICE

RIC-WIL

CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

Ask the AEROFIN Man

To Help You on Your Cooling or Heating Problems



Aerofin Corporation, through its home office and six strategically located branch offices, is prepared to help you on all problems involving the application of Aerofin heat exchange surface or to suggest the most efficient use of this superior surface to a variety of requirements.

The prompt, personal and technical cooperation of our engineers is at your disposal. Write to the home office in Syracuse or consult your local telephone directory for addresses of branch offices listed.

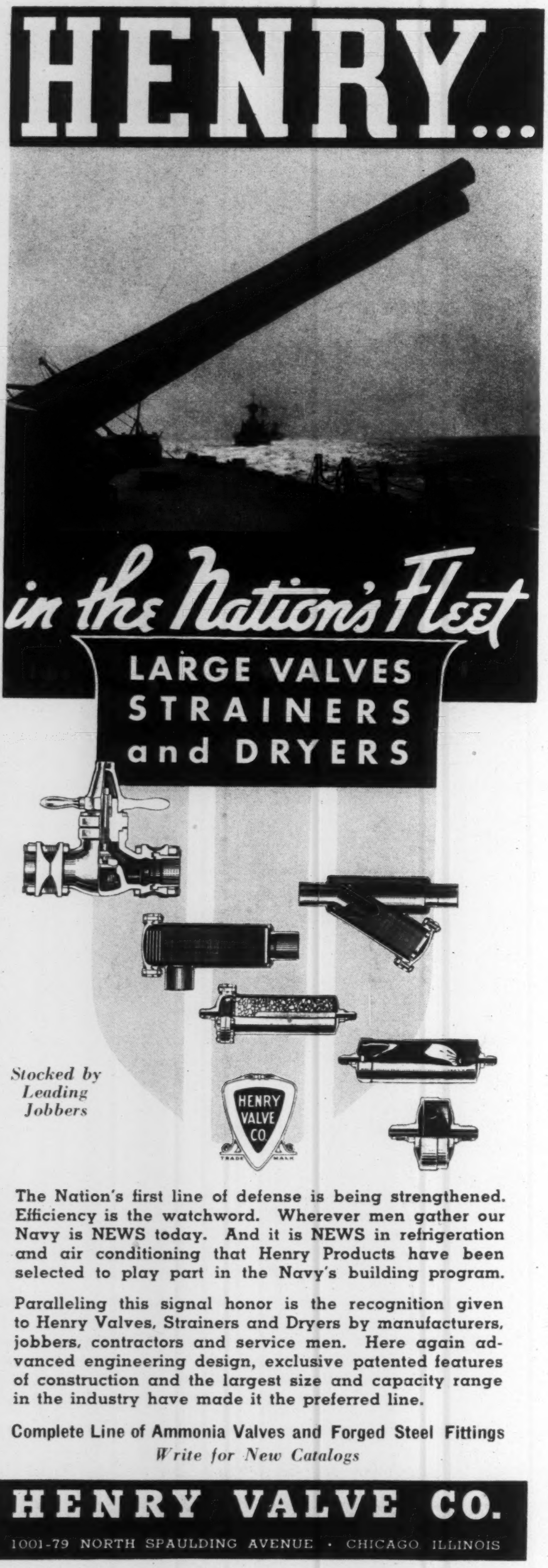
AEROFIN

Heat-Exchange Surface

AEROFIN CORPORATION

410 SOUTH GEDDES STREET, SYRACUSE, N. Y.

Chicago • Detroit • New York • Philadelphia • Dallas • Atlanta



HENRY...

in the Nation's Fleet

LARGE VALVES
STRAINERS
and DRYERS

Stocked by Leading Jobbers

HENRY VALVE CO.

The Nation's first line of defense is being strengthened. Efficiency is the watchword. Wherever men gather our Navy is NEWS today. And it is NEWS in refrigeration and air conditioning that Henry Products have been selected to play part in the Navy's building program.

Paralleling this signal honor is the recognition given to Henry Valves, Strainers and Dryers by manufacturers, jobbers, contractors and service men. Here again advanced engineering design, exclusive patented features of construction and the largest size and capacity range in the industry have made it the preferred line.

Complete Line of Ammonia Valves and Forged Steel Fittings
Write for New Catalogs

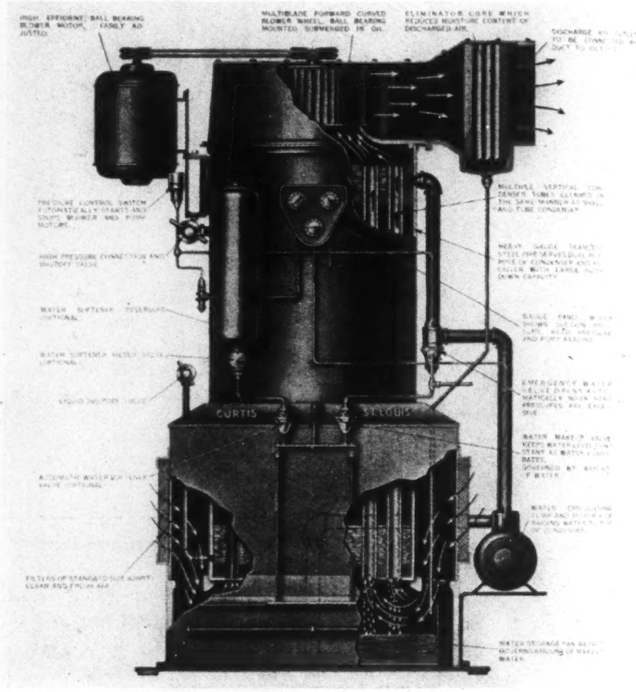
HENRY VALVE CO.
1001-79 NORTH SPAULDING AVENUE · CHICAGO ILLINOIS

The unit is manufactured in sizes ranging from 14 to 1 in. fan diameter to provide a wide choice of capacities.—De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., 100 Sixth Ave., New York, N. Y.

Evaporative Condenser Receiver Exhibited

No. 1443*—A new evaporative condenser receiver exhibited at the recent International Heating and Ventilating Exposition includes the elements of the cooling tower, condenser, and condenser receiver in one piece of equipment, which, according to the manufacturer, is compact in design, efficient in operation, and affords worthwhile economy.

The evaporative condenser is of the cleanable type. The tubes inside of which water evaporation takes place are accessible for cleaning by lifting the head and fan assembly from the condenser. Water is drawn from a pan to the head of the condenser where a fine film of water is allowed to pass on the inside of the tubes. A blower pulls air through filters and up through the tubes, resulting in a counterflow action, as the air is pulled in the opposite direction of the water flow. Refrigerant is condensed on one side of the tube surface and the water is evaporated on the other side.



HIGH EFFICIENT BALL BEARING BLOWER MOTOR, EASILY ADJUSTED
MULTIBLADE FORWARD CURVED BLOWER WHEEL, BALL BEARING MOUNTED SUBMERGED IN OIL
ELIMINATOR CORE WHICH REDUCES MOISTURE CONTENT OF DISCHARGED AIR
DISCHARGE AIR OUTLET TO BE CONNECTED BY DUCT TO OUTSIDE
PRESSURE CONTROL SWITCH AUTOMATICALLY STARTS AND STOPS BLOWER AND PUMP MOTORS
MULTIPLE VERTICAL CONDENSER TUBES CLEANED IN THE SAME MANNER AS SHELL AND TUBE CONDENSER
HIGH PRESSURE CONNECTION AND SHUTOFF VALVE
WATER SOFTENER RESERVOIR (OPTIONAL)
WATER SOFTENER METER VALVE (OPTIONAL)
LIQUID SHUTOFF VALVE
CURTIS
ST. LOUIS
AUTOMATIC WATER SOFTENER VALVE (OPTIONAL)
FILTERS OF STANDARD SIZE ADMIT CLEAN AND FRESH AIR

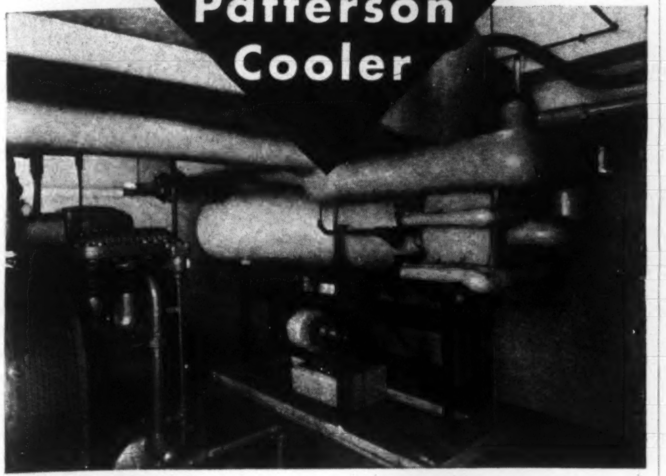
The air stream tends to hold the water in suspension, promoting rapid evaporation, hence cooling the refrigerant gas and liquid which is in contact with tubes inside of the shell. Water which is not evaporated drains back to the water pan. This pan also governs the amount of makeup water.

The evaporative condenser tubes are of copper which makes the condenser usable for methyl chloride or "Freon-12." When supplied with steel tubes, the condenser can be used for ammonia.—Curtis Refrigerating Machine Co., 1950 Kienlen Ave., St. Louis, Mo.

Duct Heater Is Gas Fired

No. 1444—Gas fired duct heater serves as a heating unit in year around air conditioning systems, operating on the same principle as a steam coil. Applicable to office buildings, theaters, stores and auditoriums, where heat requirements cannot be met with the present equipment, it will serve as an auxiliary heater, to be added to a central fan type distribution system. The required minimum air flow through the equipment is 1000 cfm. and the unit is designed to fit a standard 17¾ by 17¾ in. duct, carrying an input of 85,000 Btu per hr.

Chrysler Building Has a Patterson Cooler



Patterson Two-Circuit Cooler for air-conditioning system in the Chrysler International Salon, Chrysler Building, New York, N. Y. Installed by Airtemp N. Y. Co., Inc.

The air conditioning systems in many of the country's finest buildings are dependent upon Patterson Freon Water Coolers for perfect service.

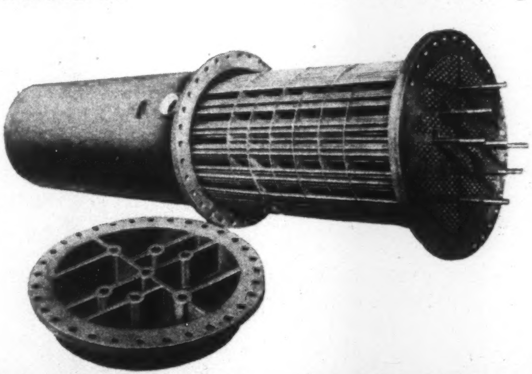
If you wish to cool water in closed or open circuits, by freon or similar refrigerants, you will find the Patterson Cooler offers many advantages.

It insures adequate superheat in the suction line, properly to operate the expansion valve. Provides permanent segregation of refrigerant charges for each compressor.

The entire tube bundle can be easily removed for inspection or cleaning. There is no danger of leakage of freon as each individual U-tube can expand or contract independently of the others. Tubes cannot pit or rust as they are made of copper.

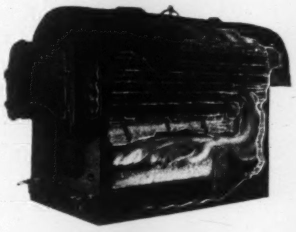
These and other vital features are fully explained in our catalog. Write for a copy.

The Patterson-Kelley Co., Inc.
107 Warren St. East Stroudsburg, Pa.



Patterson Freon Water Coolers

This Welded Steel Burnham is made in our own separate plant at Geneva, New York. Made in 19 sizes ranging in capacities from 1,800 to 42,500 sq. ft.



The Twin Sectional Cast Iron. Aside from its economy advantages, permits of replacements without any tear-outs. No part is too big to pass through the average size door. Made in 9 sizes. Rates from 7,850 to 19,450 sq. ft. of E. D. R. Steam Rating. Water from 12,600 to 31,800 sq. ft.

Because We Don't Fight For Any One Boiler

Isn't it so, that a concern that makes only steel boilers fights to the last ditch against your using a cast iron one? And the cast iron fellows, do the best to crowd out the steel?

Burnham never do either *because* we know, just as well as you do, that each type boiler has its place. All we seek is to help you get the best one for that place, be it steel or cast iron. Making both, we are in an unprejudiced position.

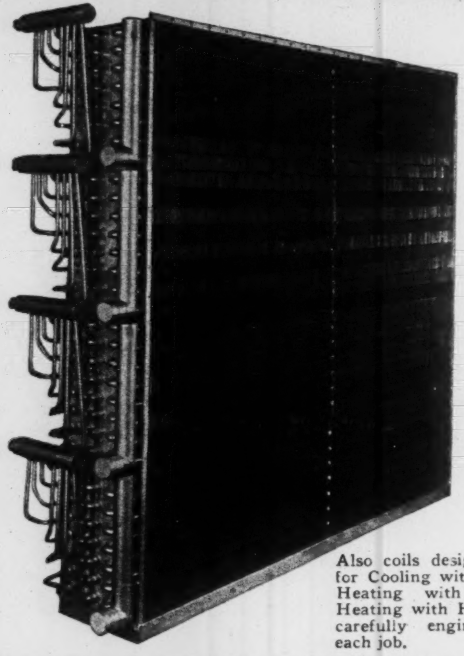
We may, however, be prejudiced in favor of Burnham. But even that ceases to be such, as performance facts must ever be *the* deciding factor with you.

Send for catalog.
Get the facts.

Burnham Boiler Corporation
Manufacturers of Heating Equipment
Since 1873
IRVINGTON, NEW YORK ZANESVILLE, OHIO
Export Department, 116 Broad Street
New York

Burnham Boiler

BUSH
AIR CONDITIONING
COILS



Also coils designed especially for Cooling with Well Water, Heating with Steam, and Heating with Hot Water . . . carefully engineered to fit each job.

COIL DESIGNED FOR DIRECT EXPANSION COOLING

It is made in 4 sections having a total surface of 3939 sq. ft. The face is 66" wide and 64½" high. The depth is 12". Each section is 8 rows high and 6 rows deep.

The Tube is ¾" tinned copper expanded into 2" square aluminum fins spaced 6 per inch.

This Coil was designed for the following conditions:
C.F.M. 12,000
Entering Air 81.7° D.B. 67.9° W.B.
Leaving Air 62° D.B. 56.9° W.B.
Freon at 45°
Calculated Load 396,000 B.T.U.'s per hour.

The headers were so arranged at the customer's request to meet his installation and engineering problems.

For Ammonia work this coil would have been all steel hot galvanized and the Header arrangement changed as conditions might indicate.

In some installations it might be advisable to operate with individual valves in which case the Liquid Feed Header could be replaced by Single Extension Tubes and the Suction Headers unchanged.

THUS THE COIL IS MADE TO FIT THE JOB.

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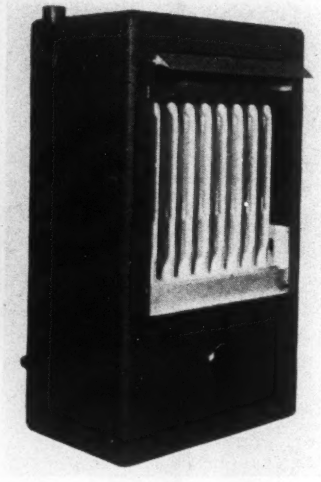


Controls for the unit are the same as those on the maker's unit heater, including a combination control valve, solenoid valve and pilot. A room thermostat can control the heat and gas supply.

Standard equipment on the unit, measuring 21⅜ by 36⅝ in., includes chromium steel alloy stream lined heat exchanger tubes and cast iron combustion chamber and flue collector; combination snap valve and pressure regulator; thermo pilot; solenoid valve; transformer; cast iron burner heads with individually raised drilled ports; fixed burner orifices; removable burner doors; and built-in draft diverter.—Bryant Heater Co., 17825 St. Clair Ave., Cleveland, Ohio.

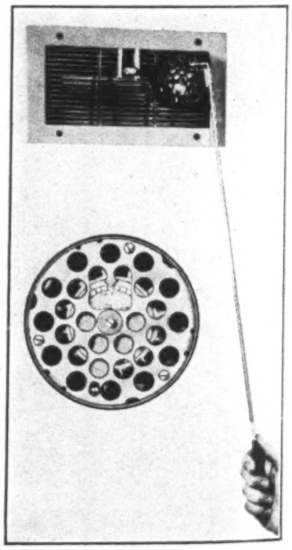
Offers Standard Dimension Blower Housings

No. 1445—"Blow-Aire" standard dimension housings for air conditioning and heat circulating wheels are made in five different diameters to fit standard 4½, 5, 6, 7½ and 9 in. diameter wheels; also furnished in all widths to suit either single or double inlet wheels. They are adaptable to room conditioning units, kitchen ventilating or individual room duct ventilating.

The inlet flange and cover plate are interchangeable on either side of the housing for either direction of wheel, which feature the manufacturer claims is of particular advantage on the single inlet units. Removable baffle or cut-out in housing outlet permits use of housing without it, in installations where practically no resistance to air flow exists and a slightly greater air volume is desired.—Detroit Stamping Co., Detroit, Mich.

Air Meter Reads in FPM

No. 1446—Two new models of the "Grillometer," a direct reading air flow meter, have been announced. One (graduated every 10 ft velocity) reads from 0 to 500 fpm velocity on a 6½ in. long scale and is recommended by the maker for balancing air conditioning systems, on natural draft work, return air, warm air furnaces, unit heaters and coolers, refrigeration condenser and evaporator checks, etc. It can be used in dark, inaccessible places with a 2 ft to 12 ft long extension arm. The other model has an orifice plate and reads from 0 to 2000 fpm on a 12 in. scale.



Other instruments in this line of direct reading air meters are available for velocity ranges of 50 to 750 fpm, 50 to 2000 fpm, and 50 to 3000 fpm.—Detroit Air Meter Co., P. O. Box 1473, Detroit, Mich.

Desuperheater for Light Loads

No. 1447—According to the manufacturer, a new steam atomizing desuperheater overcomes the problem of securing satisfactory

DRAFTLESS AIR DISTRIBUTION

FOR BARS — CAFES AND RESTAURANTS

The patrons of the Enduro Bar and Restaurant in New York City do not suffer from the danger and discomfort of drafts while wining and dining. Anemostats have solved this problem to the complete satisfaction of patrons and management.

Anemostats can solve your air distribution problem. The air distribution of any air conditioning or ventilating installation regardless of size, can be made perfect by the use of Anemostats.

The Anemostat is an accepted scientific achievement. It has solved major problems of the Air Conditioning Industry by reducing the speed of air flow to such an extent that it is no longer perceptible as a draft. The Anemostat mixes room air with conditioned air within the device, thus the predetermined room temperature is established considerably above the breathing level. The Anemostat permits greater temperature differentials, smaller ducts, smaller plants, lower installation and operating costs. The Anemostat can be applied to existing systems as well as to new installations.

Enduro Bar and Restaurant, New York City — Armo Cooling & Vent. Co., Inc., Contractors

INSTALLATION DATA—

DOWNSTAIRS—Restaurant—150 People.
Room size, 30'x60'.
Ceiling height, 10'.
Two No. 40 Type B Anemostats.
Neck Diameter 16".
each distributing approx. 1900 c.f.m. at 1360 f.p.m.

UPSTAIRS—Bar—100 People.
Room size, 30'x60'.
Ceiling height, 10'.
Two No. 35 Type B Anemostats (illustrated above).
Neck Diameter 14".
each distributing approx. 1500 c.f.m. at 1400 f.p.m.
One No. 35 Type B Anemostat Neck Diameter 14" distributing approx. 1200 c.f.m. at 1125 f.p.m.

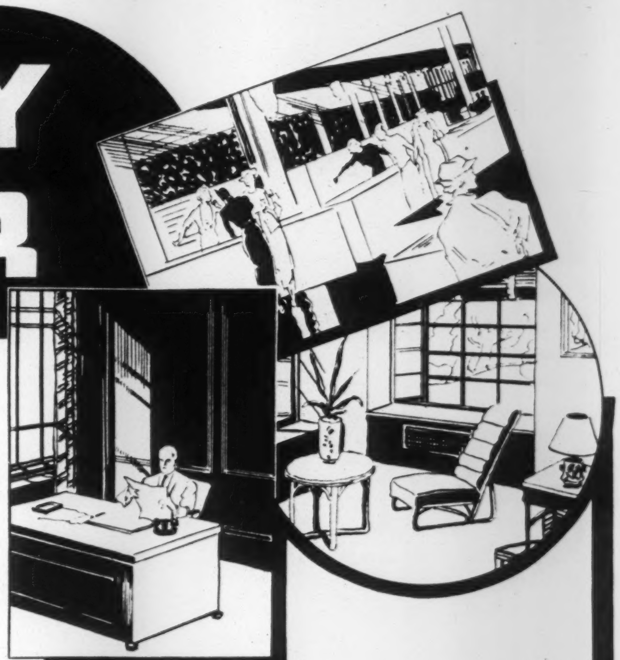
Cooling Temperature differential 18° max.

ANEMOSTAT CORPORATION OF AMERICA
10 EAST 39th STREET • NEW YORK, N. Y.

"No Air Conditioning System is Better than its Air Distribution"

AN—1

HUSSEY COPPER



For All Types of Air Conditioning Equipment

Modern air-conditioning installations demand the highest quality copper. That is why so many manufacturers prefer HUSSEY COPPER,—a standard quality specification in every industry for more than 89 years.

HUSSEY COPPER Service is as near as your telephone—a nationwide service backed by seven conveniently located Hussey Warehouses with complete stocks of copper products for air conditioning applications of every description including Housings, Air Washers, Blowers, Coils, Ducts, etc.

Write for the Hussey Catalog—chock full of practical information on copper as applied to air-conditioning applications.

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Copper **HUSSEY** *Brass*

Representative Hussey Copper Products

Sheets, Strips and Rolls
•
Rod
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Tubing
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Nails and Rivets
•
Prefabricated Roofing Materials of All Kinds

results at light loads by introducing a steam jet to atomize the cooling water so that mist is introduced into the steam pipe. This mist insures complete absorption of the water by the superheated steam, it is stated.

To secure proper results it is necessary to maintain a fixed relationship between the water and the steam used for atomizing and to do this, both are controlled by single seat, parabolic disc, streamline control valves governed by a temperature pilot. As the temperature increases, the pilot releases pressure from the diaphragms of the valves allowing them to open and supply the correct mixture to maintain a proper temperature without flooding the main steam pipe.

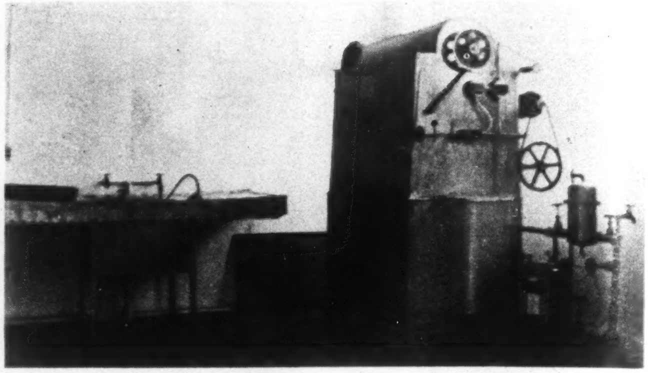
To use the above mentioned unit it is necessary to reduce before desuperheating, or supply steam for atomizing at a higher pressure than that in the main pipe. When this higher pressure steam cannot be supplied, the manufacturer offers a mechanical atomizing nozzle.—Spence Engineering Co., Inc., 32 Grant St., Walden, N. Y.

Process for Cleaning Air Filters Developed

No. 1448—A process has been developed for cleaning dirty air filters and a machine and equipment for handling this work has been designed. Plants to furnish the service have been established in Omaha, St. Louis, Chicago and Detroit, and it is planned to open additional plants in larger cities throughout the country as soon as possible. The illustration shows some of the equipment at the Omaha plant.

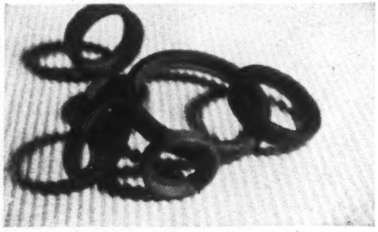
In the cleaning operation the filters are framed with a metal frame and placed in the cleaning machine, which accommodates eight filters at a time. The temperature of the solution is kept at boiling point during the entire operation, and after the filters have been cleaned they are placed in a sterilizing bath at boiling temperature to insure a sterile filter. The filters are then placed in a drying oven, after which they are oil treated.

According to the company that has developed this cleaning process, filters can be cleaned and conditioned over and over again, which leads to a material saving in air conditioning maintenance cost.—Whalen Air Filter Cleaning Co., Inc., 213 S. 12th St., Omaha, Neb.



Plastic Pipe Ends Prevent Grounds

No. 1449—"Dilecto" pipe ends are a molded laminated plastic product with high electrical insulating properties, good mechanical strength, and which are unaffected by water, steam, chemicals, or chemical fumes, or by high or low temperatures or rapid temperature changes, according to the maker. They are designed to prevent dangerous grounds and are made in two styles; threaded to fit standard pipe and conduit thread; or plain with three set screws for fastening.



Both types are made in standard sizes from ½ to 4 in., and special sizes can be furnished to order.

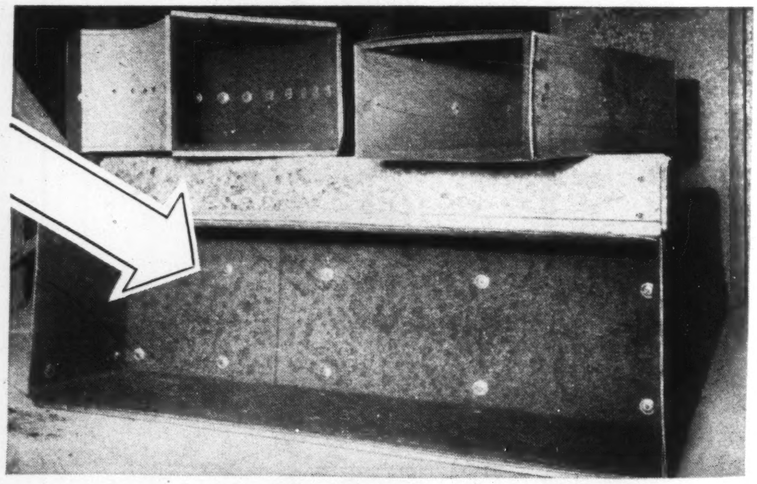
NO FIRE HAZARD HERE!

SERIOUS LOSSES have been reported in buildings where combustible sound absorbents—used to line air-conditioning ducts—have caught fire*.

The use of Johns-Manville Airacoustic Sheets for duct lining permanently eliminates this costly, unnecessary threat. Not only do these sheets provide as high as 80% sound absorption—but also, *they cannot burn or smolder. Can never contribute to fire spread.*

Furthermore, J-M Airacoustic Sheets are mineral in character . . . hence, permanent. Highly resistant to moisture . . . a serious enemy to the life of any material used in air-conditioning equipment. Light in weight, they are easily handled, quickly applied. Thermal conductivity is low; transverse strength high. And being smooth-surfaced—Airacoustic Sheets have a low frictional resistance.

For complete data on J-M Airacoustic Sheets, write Johns-Manville, 22 East 40th Street, New York City.

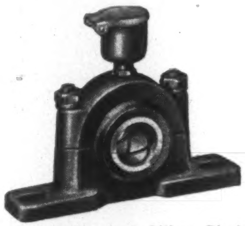


JM Johns-Manville
AIR ACOUSTIC SHEETS FOR DUCT LINING

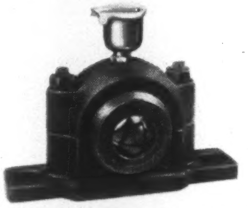
* **In our files are bulletins from The National Board of Fire Underwriters, reporting several cases of this very nature.**

Whether you use RANDALL BEARINGS for QUIETNESS or EFFICIENCY, you get both!

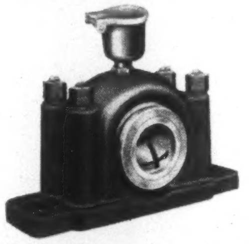
Quiet



* Randall Standard Pillow Block (single reservoir)



* Randall D. R. O. R. Pillow Block (double reservoir)



* Randall Universal Pillow Block (double reservoir). Ball can be turned so that mounting can be made in any of four positions.

* Randall Flange or Side Mount Pillow Block (double reservoir). For mounting on cabinet type air conditioners and unit heaters.

Shown with large special oiler.

When Randall Bearings are used in air conditioning blowers, contractors and distributors are assured of freedom from complaints about bearing noises and bearing failures. These problems are completely solved because Randall Pillow Blocks run efficiently, quietly and without metallic bearing noise.

They are self-aligning, self-lubricating, and can operate without attention for long periods. They are dependable and with reasonable care will last for years.

All Randall double reservoir Pillow Blocks have the advantage of great reserve oil supply, both reservoirs feeding lubricant to the shaft as needed. (In addition all types can be furnished with large oil cups as shown.)

Randall Pillow Blocks are standard equipment on leading makes of air conditioning and blower units. Write for full information.

PACIFIC COAST STOCKS

Utility Fan & Mfg. Co.
Los Angeles, Cal.

C. W. Marwedel
San Francisco, Cal.

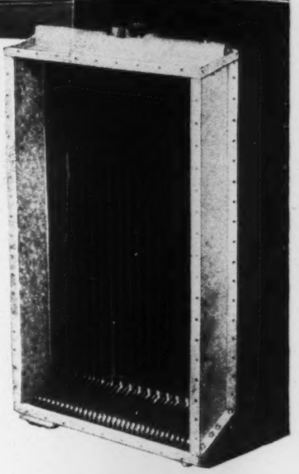
•

Randall GRAPHITE PRODUCTS CORP.
Dept. 410, 609 W. Lake St., Chicago. Ill.

National Archives Building, Washington, D. C.

Architect, John Russel Pope, New York City. Contractor, McCloskey & Company, Philadelphia, Pa.

Modine Blast Heaters are installed in the ten million dollar National Archives Building. In this structure, one of the most beautiful and best planned in Washington, the temperature, humidity and chemical content of the air must be carefully regulated to prevent deterioration of documents, films, etc. stored there.



THE NEW MODINE BLAST HEATER

● Entirely new in design . . . stronger structurally . . . more effective in high heat transfer . . . closely adaptable to automatic control . . . the New Modine Blast Heater satisfies even the most exacting demands of the newest applications for heating surface.

MODINE MANUFACTURING COMPANY
1772 RACINE STREET • RACINE, WISCONSIN

Free
To ARCHITECTS ENGINEERS and CONTRACTORS

HEATING, COOLING
AND AIR CONDITIONING FOR
INDUSTRIAL, COMMERCIAL
AND
RESIDENTIAL APPLICATION

NEW 48-page BOOK, with metal binding, printed in three colors . . . fully describes the New Modine Blast Heater . . . its superior construction and design, with complete physical and engineering data, piping and system diagrams, etc., and installation illustrations.

Ask for Catalog No. 337.

NOTICE TO TENANTS
Please turn off heat at radiators instead of opening windows Thank you.
The Management

THE owner of a midwestern office building recently distributed the following notice to tenants:

"To comply with the request of various tenants that something be done to more evenly heat the offices, we are going to try operating our steam heating system for the next 30 days without the thermostat controls. We are asking your cooperation. In the event your offices are too warm, please turn the heat off at the radiator instead of just opening the window. Thank you."

When ordinary thermostat control proves inadequate for the heating of a large building, the proper procedure is to secure the service of an organization with specialized experience in the heating and control of large buildings.

The difficulty apparent in the case reported would not occur with a Webster Moderator System because the Moderator System provides (1) balanced steam distribution throughout the entire system and all radiators, (2) delivery of heat *continuously* to all radiators varied according to need, (3) automatic change in heating rate of each radiator with changes in outdoor temperature, (4) convenient and useful manual adjustments which supplement the automatic control to assure both maximum economy and maximum comfort.

No Need To Beg Tenants To Save Steam With Webster Moderator Systems

There is an impressive list of building owners who have solved the problem of tenant discomfort and wasteful heating by installing Webster Moderator Systems. Many concise "case histories" have been reported in this column during the past two years. Many more will be similarly reported in future issues.

Have you investigated the possible benefits of a Webster Heating Modernization Program for your building? If not, write us. You incur no obligation.

1888 WARREN WEBSTER & CO., CAMDEN, N. J. 1938
Pioneers of Modern Steam Heating
50 YEARS OF HEATING PROGRESS

Consult nearest Webster Representative

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CLEVELAND
COLUMBUS
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DAYTON
DENVER
DES MOINES
DETROIT
EASTON
EL PASO
GRAND RAPIDS
GREAT FALLS
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YORK

IN CANADA DARLING BROS LTD., MONTREAL

WEBSTER
MODERATOR
CONTROL
"Control-by-the-weather"

When the threaded pipe ends are used it is recommended that they be tightened with strap wrenches, although with care regular pipe wrenches may be used.—Continental-Diamond Fibre Co., Newark, Dela.

Combined Control for Unit Ventilators

No. 1450—"Microventrol" is a combination valve and damper controller for use with unit ventilators. It incorporates a shaded pole, reversing motor, and operates with the potential dividing rheostat to balance the solenoid in any of the "Micro" controlling instruments. This unit gives full proportioning to any of the conventional or special cycles adopted by unit ventilator manufacturers, the maker states.

The operator of this unit is mounted on the valve, and throttles the steam supply directly through a cam and plunger mechanism. The extended power shaft of the motor is connected through a linkage to the damper of the unit, and is adjustable to accomplish variable minimum air requirements on the damper, and proportioning of air supply as specified for various operating cycles.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Instrument Determines Combustible Gas Hazards

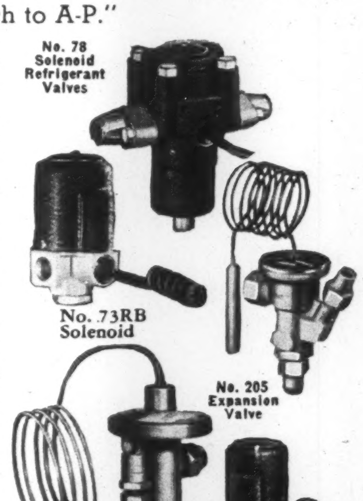
No. 1451—New "M. S. A." explosimeter is a pocket-size indicator that can be carried about on the job and operated by any workman. A test with the instrument requires only the adjust-

CHIEF ENGINEER OF A FAMOUS HOTEL Says...

"Every Refrigeration Valve that needs Service here..is replaced with an A-P Valve.... Then.... Trouble Stops!"

"Valve Trouble" is one form of Air Conditioning and Refrigeration Service that is very quickly remedied by a "Switch to A-P."

The day-after-day Dependability of A-P Thermostatic Expansion Valves and Solenoids — running into years of satisfactory operation — is one of the main reasons for their enthusiastic acceptance and demand by the Experts of the Industry, Refrigeration Service Engineers, Engineers interested in the maintenance of low cost operation of Refrigeration and Air Conditioning installations, all agree on the superiority of A-P Valves —and demand them from Supply Jobbers. Prove them on your own installations.


No. 78 Solenoid Refrigerant Valves
No. 73RB Solenoid
No. 205 Expansion Valve
No. 210 Expansion Valve
No. 70 N. A. Solenoid Refrigerant Valves

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2460 NORTH THIRTY-SECOND STREET
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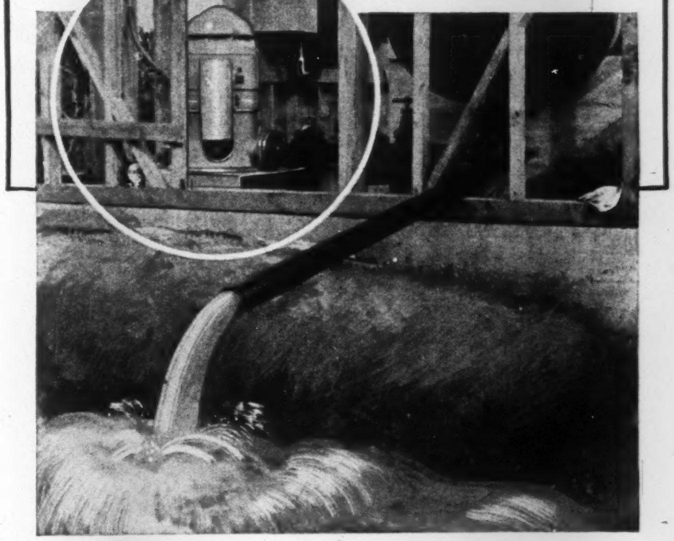
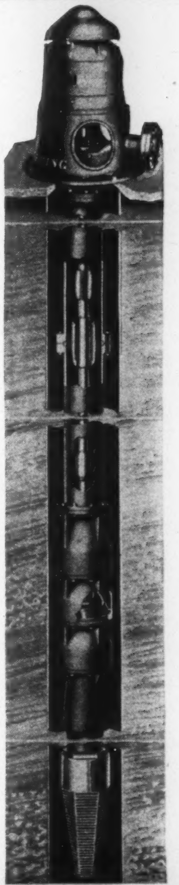
DEPENDABLE
THE BYWORD FOR A-P CONTROLS

Economical
AIR COOLING





Note the Advantages of

DEMING TURBINE PUMPS

When this installation is completed, the Deming Turbine Pump illustrated above will pump well water for an air cooling system, furnish general water supply as well as irrigate acreage of a large estate in Pennsylvania.

For low first cost and low upkeep cost in any air cooling system, Deming Turbines are efficient for pumping water:

1. Directly through water cooling coils.
2. In conjunction with direct expansion in a split system.
3. Through water cooler (brine, freon, methyl chloride or ice.)
4. To eliminate sun load by spraying roof.
5. For cooling compressors.
6. For washing air.

Write for *new* Deming Turbine Bulletin containing complete information.

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AIR-CONDITIONING DUCTS
WITH CORK
for efficient, low-cost delivery of cool air . . .

AIR CONDITIONING engineers and plant operators recognize that cork is nature's best insulator. That is why cork insulation, in the form of Novoid Corkboard, is so widely used to protect air conditioning systems. Properly installed on round, square or rectangular ducts, Novoid Corkboard effectively resists the passage of heat, and prevents condensation. This efficient, long-life material helps assure more accurate control of temperature, and substantially reduces operating costs.

For insulating air-washing rooms, Novoid Corkboard is equally effective and guards against costly infiltration of warm air. Novoid is structurally strong, light in weight, and available in handy board sizes of 12x36, 18x36, 24x36, and 36x36 inches. Thicknesses range from one to six inches. For complete information, mail the coupon today.

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Cork Import Corporation,
330 West 42nd Street, N. Y. C.
Please send me complete details of Novoid Corkboard and its application to air ducts.

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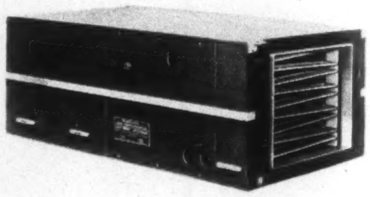
ment of a single control and the operation of a piston type pump. The gas concentration is read on the indicating dial and, according to the maker, the sensitivity is such that gas concentrations below the lower explosive limit—as low as a few hundredths of one per cent by volume—can be measured.

The instrument shows whether the gas concentration is within or above the explosive range, a dilution tube of novel design being available to make possible comparative readings of the higher concentrations.

The instrument weighs about 3 lb complete with batteries, and overall dimensions are 1$\frac{11}{16}$x7x4¼ in.—Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa.

Apartment House Type Air Conditioner Offered

No. 1452—New "apartment house type" air conditioner for application in apartments, hotel suites, offices, shops, restaurants and residences is offered as a compact unit to provide year 'round air conditioning with automatic control of each function. It may also be had for winter air conditioning only, or summer air conditioning only.



Available for operation with either steam or hot water, a separate design of heating coil is used for the different mediums. The coils are of the copper fin and tube type and are of copper or copper alloy construction from inlet to outlet castings. The cold water cooling coils are designed for use with tap water, well water, non-corrosive brine, or water precooled by ice or mechanical refrigeration.

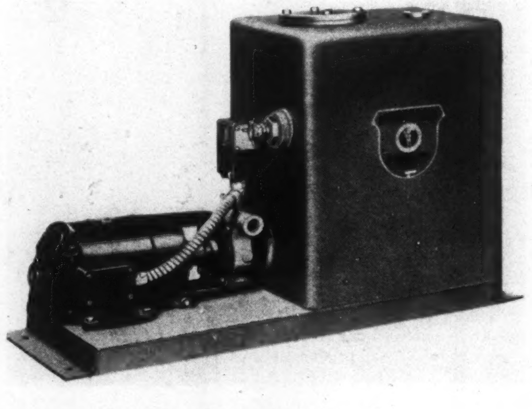
Feature of construction is that access doors to the motor and blower, control panel, water valves, heating and cooling coils, and humidifier trays are on one side of the unit only and all piping and conduit connections are made from this same side through one end. The unit therefore can be installed with only one side exposed, with the rest of the cabinet flush with adjoining surfaces.

The smaller of the two units has a heating capacity of 74,000 Btu per hr and a cooling capacity of 27,300 Btu per hr, and has a single blower. The larger model has a little more than twice the heating and cooling capacity of the smaller one, and includes two blowers and two sets of humidifier trays.—Modine Mfg. Co., 17th St., Racine, Wis.

Condensation Pump Announced

No. 1453—New line of "Hot Shot" condensation return pumps comes in six ratings from 1000 to 16,500 sq ft of radiation, or ½ to 25 gpm.

The receiver is welded copper bearing steel and the float switch has cadmium plated brass float and working parts, and operates through a stuffing box 4 in. deep. The switch is mounted on a screw-in connection through which the whole mechanism can be removed.



The unit comes complete ready for pipe and electrical connections.—Yeomans Brothers Co., 1433 N. Dayton St., Chicago, Ill.

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Merchandise sold by the responsible plumbing and heating jobber bears the stamp of dependable quality. For this reason, if for no other, it pays to deal with him exclusively.

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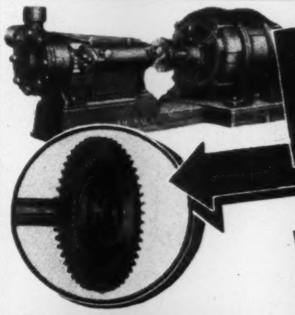

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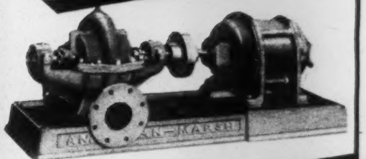

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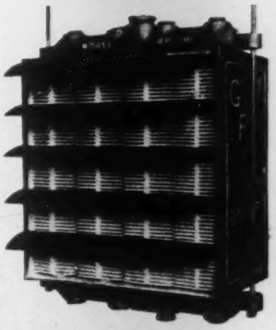
pioneered the idea of large air volume at lower outlet temperature

EVEN IN HEATING PRACTICES THERE ARE PIONEERS...

And, as the original pioneers had followers—those who came after them once the trails were broken—so have the pioneers in heating practices followers. The idea we pioneered—and continue to practice in our manufacture of unit heaters—is now generally accepted by others. Recent news items in trade journals show that.

Grid today stands as the one unit heater that not only produces a large air volume with more air changes per hour, but entirely eliminates electrolysis and its resultant corrosion. Complete details upon request.



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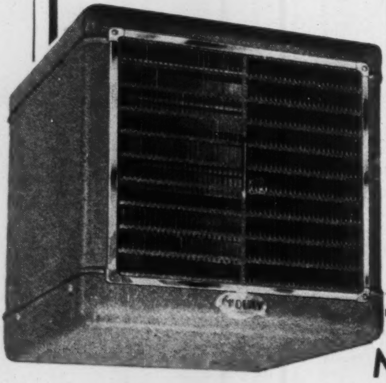

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Schools and Study Courses

Extension Course in Oil Burner Engineering

The University Extension Division of Rutgers University, New Brunswick, N. J., offers a home study course in oil burner engineering. Prepared in 15 sections, it includes charts and diagrams for layout of oil burner systems, automatic control devices, trouble charts of motors, calculation of heating requirements, and heat insulation of walls, roofs, and floors in old as well as in newly constructed buildings.

A complete listing of the various types of oil burners is an additional feature. A section is devoted to the essentials of heating equipment, air conditioning and other developments in this field.

The fee is $24.00, payable on enrollment.

Extension Instruction in Hydraulics

The Extension Division of the University of Wisconsin, Madison, announces that its elementary course in hydraulics—the basis of designs for the distribution of water, collection of sewage, and transportation of oils—was fully revised in January and now includes the latest applications of researches which make the computations fit the actual movement of fluids more accurately. The subject is taught by the department of civil and structural engineering by the correspondence study method.

This course teaches the fundamental theory of hydraulics, including the flow of fluids in pipes and open channels, the various devices used to measure flowing fluids, and the pressure of fluids in submerged surfaces. Included in it is a practical application of the viscosity of fluids and of the ratios used to make the formulas applicable to different conditions and fluids.

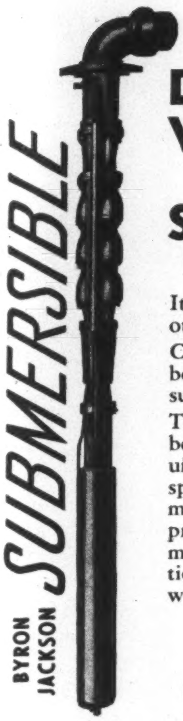
Research in Air Conditioning at Cornell

Various problems of fundamental importance to efficient air conditioning, involving temperature, humidity, purity, and velocity, are being studied by research experts in the Sibley College of Mechanical Engineering at Cornell University, Ithaca, N. Y. The study of "Heat Transmission from Radiators" by K. F. Rubert, recently published as Bulletin No. 24 (price, 45c) of the Cornell engineering experiment station, is the latest of a series that will be continued with greater frequency when the proposed heat transfer laboratory is completed.

Radiators give off heat primarily by direct radiation, which may take place even in a vacuum, and by convection, the transfer of heat to particles circulating in the air. Since radiation accounts for between 40 and 50 per cent of the heat transmitted, any factor which decreases it lowers the efficiency of the radiator. The use of a highly reflecting paint, such as bright aluminum bronze, on the surface of a radiator may reduce the heat output as much as 25 per cent, Rubert found. Flat paints, particularly flat black, allow a high degree of radiation. The use of reflecting surfaces behind radiators will considerably increase the amount of heat emitted.

Accurate measurement of the temperature and humidity of air is one of the most complex problems facing research workers. As explained by Prof. W. M. Sawdon, who directs heat transfer research, a thermometer inside a room is influenced by radiation from walls, furniture, and other objects, and also by the velocity of the circulating air. Velocity alone may account for errors as high as 2½ per cent. Radiation may contribute to even greater errors. Professor Sawdon asserts that the weather bureau's thermometer above Roberts Hall at Cornell has been incorrect by ten degrees or more on various occasions, largely because of radiation from the building.

The records of wet bulb thermometers have been shown by



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It is ideal for air conditioning systems—or any other application where unfailing service is vital.

Close-coupled motor and pump are attached to bottom of column pipe and operate completely submerged in the well.

The Submersible is quiet, out of sight, and can be installed in wells located in the building, under a walk, drive, parkway or other restricted space. No pump house or other surface equipment is required; only a weather-proof, tamper-proof switch-box which permits manual or automatic control, local or remote. Many installations now in service have operated for five years without oil addition.

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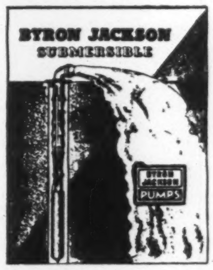

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Right from the start Darts are fitted for a life of tough service with plenty of ups and downs. First: Dart's two bronze seats are ground to a true ball joint that gives wide, full bearing contact over its entire seating surface. . . This makes Darts sit tight not just once, but time and time again, as often as installed. And Dart bodies and nuts are made of extra-heavy air-refined malleable iron, to resist pipe strains, thread distortion and wrench abuse. . . These extra Dart features assure lowest cost on your lines, longest life in service. Write for a Dart to try—*at our expense.* No obligation.

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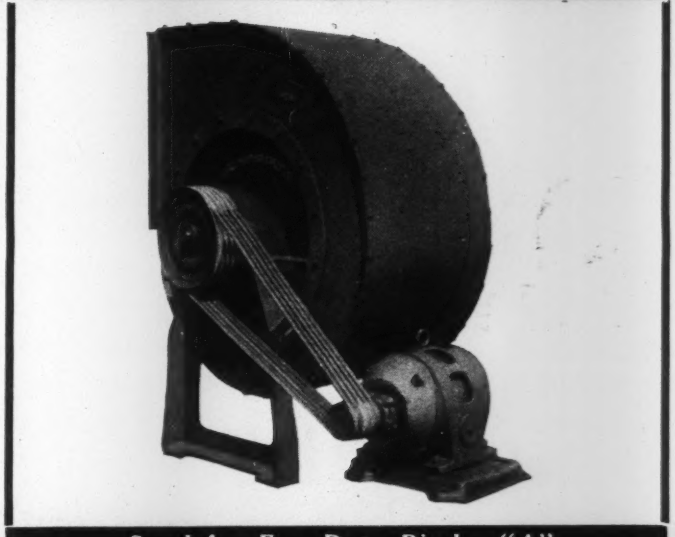

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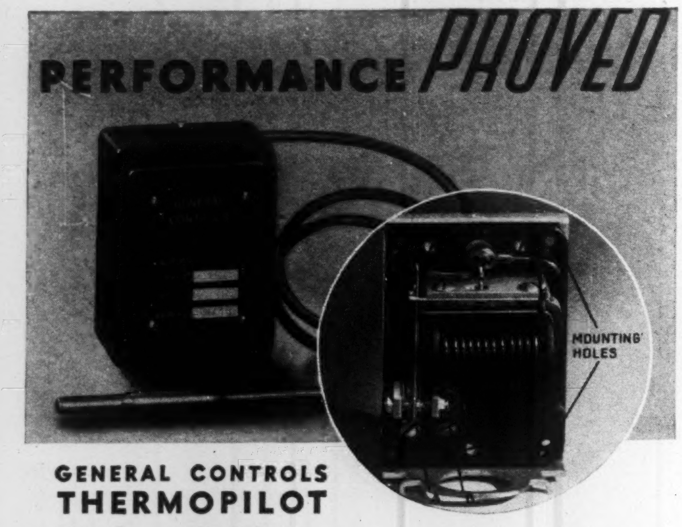

PERFORMANCE PROVED

GENERAL CONTROLS THERMOPILOT

For six months this new automatic thermo-couple pilot ran the gauntlet of severe tests in General Controls laboratories before its release to the trade. Since then, air-conditioning equipment manufacturers have subjected the THERMOPILOT to similar tests. The result is . . . the THERMOPILOT offers unfailing dependability on the job!

The Thermopilot employs the proved thermocouple principle. When flame is applied to the tip, contact is made, allowing main gas valve to open. Upon pilot failure, Thermopilot opens circuit to main gas valve, which then closes. Automatically resets itself. Flexible thermocouple tube for easy installation. Couples detachable.

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David Dropkin, research assistant, to be at times unreliable. By the use of apparatus including a set of specially constructed thermometers Dropkin has proved that adiabatic saturation, the basis of wet bulb measurement, is not always accurately indicated by the instrument. Differences are caused primarily by changes in the velocity of the air surrounding the thermometer.

One of the ways air conditioning problems will be attacked in the new heat transfer laboratory is the testing of various building materials to discover their coefficients of heat transmission.

Conventions and Expositions

Heating and Air Conditioning Conference: April 6-8, Iowa State College, Ames, Iowa.

American Foundrymen's Association: Second annual New England conference, April 8-9, Massachusetts Institute of Technology, Cambridge, Mass. Includes discussion of dust control principles in foundry operations.

Midwest Power Conference: April 13-15, La Salle Hotel, Chicago, Ill. Under sponsorship of Armour Institute of Technology with the cooperation of six midwestern state universities. Director, L. E. Grinter, Armour Institute of Technology, Chicago, Ill.

American Water Works Association: Annual convention, April 24-28, New Orleans, La. Relation of water supply and air conditioning will be discussed. Headquarters' office, 29 W. 39th St., New York, N. Y.

Anthracite Conference: April 29-30, Lehigh University, Bethlehem, Pa. Conference chairman, Dr. Herman Eckfeldt, Professor of Mining Engineering.

American Foundrymen's Association: Annual convention, May 16-19, Public Auditorium, Cleveland, Ohio. Headquarters Office, 222 W. Adams St., Chicago, Ill.

Smoke Prevention Association: Annual convention, May 17-20, Andrew Jackson Hotel, Nashville, Tenn. Display of commercial exhibits and educational exhibit to be held in conjunction. Headquarters' Office, 139 N. Clark St., Chicago, Ill.

Heating, Piping and Air Conditioning Contractors National Association: 1938 convention, May 31-June 2, Boston, Mass. Chairman of Convention Committee, Frank E. Kise. Headquarters Office, 1250 Sixth Ave., New York, N. Y.

National Warm Air Heating and Air Conditioning Association: Mid-year convention, June 13-15, Plankinton Hotel, Milwaukee, Wis. Managing Director, A. W. Williams, 50 W. Broad St., Columbus, Ohio.

American Society of Heating and Ventilating Engineers: Semi-annual meeting, June 20-22, The Homestead, Hot Springs, Va. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

National Association of Building Owners and Managers: Annual convention, June 20-23, Hotel Schroeder, Milwaukee, Wis. Association headquarters, 134 S. LaSalle St., Chicago, Ill.

American Society of Refrigerating Engineers: Food preservation conference, June 20-24, at Pennsylvania State College, sponsored by the A. S. R. E. and a number of universities. Headquarters' Office, 37 W. 39th St., New York, N. Y.

American Society for Testing Materials: Annual meeting, June 27-July 1, Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary-Treasurer, C. L. Warwick, 260 S. Broad St., Philadelphia, Pa.

National District Heating Association: Annual convention, June 28-July 1, Lord Baltimore Hotel, Baltimore, Md. Secretary-Treasurer, William H. Sanford, 1317 Spruce St., Philadelphia, Pa.

National Industrial Advertisers Association: Annual conference, September 21-23, Cleveland, Ohio. Committee Chairman,

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Throughout the deep well pumping field, men pay tribute to the excellence of Peerless engineering design. They have seen Peerless Pumps consistently out-perform other makes; they have observed their uniformly low power and repair cost. They know from experience that a Peerless is worth the difference in freedom from operating troubles alone.

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So understandably does this new volume cover all angles of air conditioning that already dozens of schools teaching air conditioning have adopted it as a text. From it anyone may quickly acquire a thorough knowledge of equipment, psychrometry, refrigeration, humidification, dehumidification, heat transmission, heat absorption, air distribution, and water circulation. It also explains every step in the design of a complete heating and cooling system for a typical residence and a typical commercial building.

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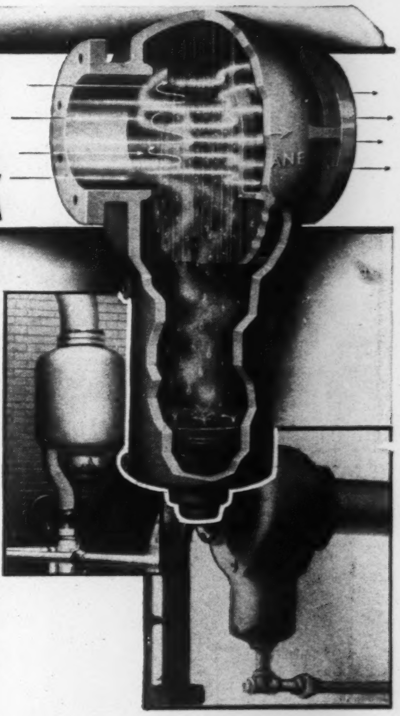
DIRTY, WET, OILY STEAM



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COCHRANE
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Dirty, oily, wet steam, air and gases are costly to equipment and production processes. Cochrane All-Service Separators will completely remove moisture and solid entrainment that may be destructive to expensive steam-consuming equipment – turbines, engines, pumps, evaporators, cooking vessels, stills, etc.

Cochrane Separators assure complete purification due to exclusive construction features of the baffles and ports. These produce a direct, unrestricted fall of the entrainment, prevent the purified steam from passing over the drip area and again becoming contaminated, and minimize pressure loss through extra large port areas.

More than 10,000 plants in every industry have definitely demonstrated the exceptional service and economy of Cochrane Separators.

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One of the big safeguards in owning a Pomona Pump is that it comes from factories that specialize on deep well turbine pumps—factories that know pumps and wells and the requirements of the heating and air conditioning industry. From these facts comes the world leadership in the number of Pomona Pumps BOUGHT.

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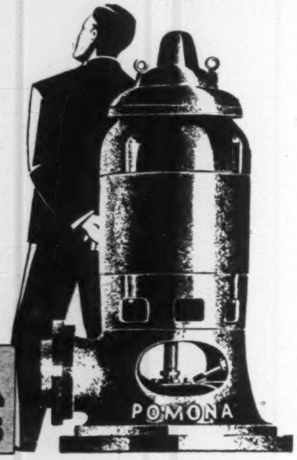
POMONA TURBINE PUMPS



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Annis Air Filters and Annis Odorpak Filters remove dust, soot, oil, and smells, including tobacco, cooking, body odors, etc.

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air as cold as 11° (and even colder!)

You may NEVER need a unit cooler that will cool down to 11°, but it's a satisfaction to know that when you need a UNIT COOLER you can get just what you want from Rempe. For any refrigerant, in any size, for any temperature. Beautiful! Efficient!

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Stanley Knisely, Advertising Manager, Republic Steel Corp., Republic Bldg., Cleveland, Ohio.

American Welding Society: Annual meeting (in conjunction with Metals Congress Exposition), October 17-21, Detroit, Mich. Secretary, M. M. Kelly, 33 W. 39th St., New York, N. Y.

American Public Health Association: Annual meeting, October 25-28, Kansas City, Mo. Headquarters Office, 50 W. 50th St., New York, N. Y.

Power Show: National Exposition of Power and Mechanical Engineering, December 5-10, Grand Central Palace, New York, N. Y. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 142. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING

No. 2713. AIR CONDITIONERS: Modine Mfg. Co., 17th St., Racine, Wis. 12 p. bulletin (No. 638) on new apartment house type air conditioners for apartments, residences, hotel suites, offices, shops, restaurants, etc., for year 'round air conditioning.

No. 2714. AIR CONDITIONING: Kelvinator Div., Nash-Kelvinator Corp., 14250 Plymouth Rd., Detroit, Mich. Looseleaf booklet illustrating and describing what air conditioning can do for various businesses, showing the manufacturer's line of equipment, and giving data on the effect of summer air conditioning on business of restaurants and shops, and advantages in offices. Inserted sheets give technical data on equipment.

No. 2715. AIR CONDITIONING: Standard Air Conditioning, Inc., 40 W. 40th St., New York, N. Y. Circular addressed to prospective users on what to consider when thinking of air conditioning, illustrating various types of equipment.

No. 2716. AIR CONDITIONING UNITS: Fedders Mfg. Co., Inc., 57 Tonawanda St., Buffalo, N. Y. 36 p. bulletin (No. AC-201-A) on "all season" air conditioning units, giving complete rating and technical information, describing features, and with detailed examples on selection. Many graphs and tables are included.

No. 2717. BLOWER HOUSINGS: Detroit Stamping Co., 3457 W. Fort St., Detroit, Mich. 6 p. bulletin on "Blow-Aire" blower housings of standard dimensions, with detailed dimensional drawings and brief description of features.

No. 2718. CONDUIT: S. E. Dockstader, 305 Munsey Bldg., Washington, D. C. Leaflet illustrating and describing "Air-Stone" conduit for underground steam lines.

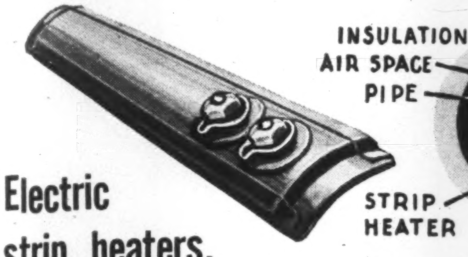
No. 2719. CONTROLS: Alco Valve Co., Inc., 2628 Big Bend Blvd., St. Louis, Mo. Looseleaf catalog (No. 15) on engineered refrigerant controls, including thermostatic expansion valves, automatic expansion valves, magnetic stop valves, float switches, and float valves. Simplified and indexed to facilitate use. Includes several pages of application information, charts, and price lists.

No. 2720. CONTROLS: Detroit Lubricator Co., 5900 Trumbull Ave., Detroit, Mich. 36 p. condensed catalog (No. 100) on "Genuine Detroit" automatic controls and equipment for lubrication and all types of heating, refrigeration and air conditioning. List prices are included.

No. 2721. DYNAMIC PRECIPITATORS: American Air Filter Co., Inc., 107 Central Ave., Louisville, Ky. 16 p. bulletin (No. 274) on "Roto-Clone" dynamic precipitator, a combined exhaust and dust separator with water sprays. Engineering data and performance tables are given.

No. 2722. FITTINGS: S. R. Dresser Mfg. Co., 490 Fisher Ave., Bradford, Pa. 16 p. booklet on "no-thread" fittings to connect plain end pipe without threading. Features and appli-

TO HEAT PIPES ELECTRICALLY



Electric strip heaters, curved in cross section, clamp along the pipe

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For complete information on this and many other electric heat applications, write for the 64-page Chromalox Book of Electric Heat. For cooperation in the solving of any specific heating problem, refer to the Wiegand engineering staff, experts on all questions of electric heat.

Here is another application of CHROMALOX strip heaters, designed to make the many advantages of this simple form of electric heat available for the heating of pipes, circular tanks, etc. Chromalox electric strip heaters can be obtained curved to any required radius from 1½ in. up, to clamp lengthwise along the pipe to be heated. A very economical method of heating is thus obtained. The compactness of the application makes it simple to provide heat insulation over both strip heater and pipe.

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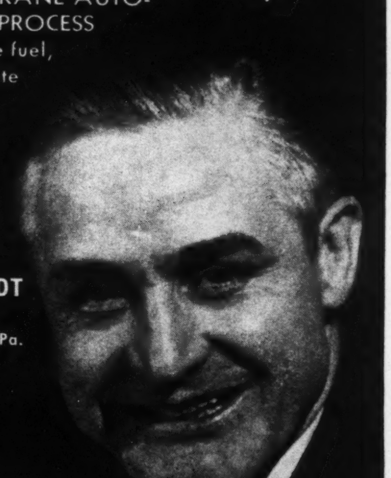
A dollar saved is a dollar made! Use an independent source for process steam this summer — shut down your heating boilers. Get a KANE AUTOMATIC, GAS FIRED PROCESS STEAM BOILER; save fuel, time and labor — write off the investment with the savings. You can do it! Details on request. No obligation.



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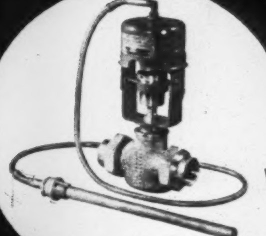

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Pays back its cost several times a year

OVERHEATED water causes complaints, wastes fuel — shortens life of valves and plumbing fixtures and increases deposit of lime in pipes. • Powers regulators will help to reduce these losses. Install them on your hot water heaters. They keep the water at the right temperature. Fuel savings alone often pay back their cost several times a year. As they usually last 10 to 15 years they pay big dividends. *Write for Bulletin 2035.*

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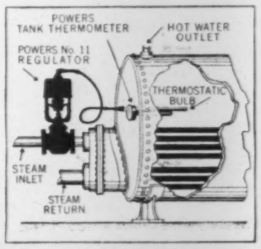


POWERS
AUTOMATIC
WATER TEMPERATURE CONTROL

cations are described and illustrated, and specifications and list prices given.

No. 2723. FLEXIBLE METAL HOSE: Eclipse Aviation Corp., 545 N. Arlington Ave., East Orange, N. J. Circular of information on seamless flexible metal hose of various types, and its uses.

No. 2724. FLOAT SWITCHES: General Electric Co., 1 River Rd., Schenectady, N. Y. Data sheet (No. GEA-67E) on float switches for use with automatic pumping equipments for water level control.

No. 2725. FUEL OIL TREATMENT: Magnus Chemical Co., Garwood, N. J. Leaflet on "Clerex" treatment for preventing sludge, gum, rusting and pitting in fuel oil heating systems, and for eliminating smoking, plugging of valves and piping, carbon and clogging.

No. 2726. GASKETS: International Nickel Co., Inc., 67 Wall St., New York, N. Y. Issue of "Nickelsworth" (Vol. 2, No. 1), including information on "Monel" gaskets used on piping for 1100 F steam.

No. 2727. HEATING: American Radiator Co., 40 W. 40th St., New York, N. Y. 12 p. booklet on new "Arco Thermo" forced warm water heating system for smaller installations, with heat distributing units consisting of a radiator and a fan driven by an air motor. The components of the system are described and illustrated.

No. 2728. HEATING: H. A. Thrush & Co., Peru, Ind. 4 p. bulletin on "Flow Control" balanced single main warm water heating system. Also 4 p. bulletin on "Kleen-Tube" water heater for use with this system.

No. 2729. HUMIDIFYING CONDITIONERS: Trane Co., La Crosse, Wis. 4 p. bulletin on new humidifying conditioner, describing features and giving dimensions and capacities.

No. 2730. INSULATION: Armstrong Cork Products Co., 994 Concord St., Lancaster, Pa. Issue of "Armstrong Insulator" (Vol. 8, No. 1) with information on various applications of cork insulation, including its use for the Gimbel department store air conditioning system.

No. 2731. INSULATION: Ehret Magnesia Mfg. Co., Valley Forge, Pa. Looseleaf catalog (No. HI-100) on 85 per cent magnesia insulations with data on selection of heat insulating materials, general information on 85 per cent magnesia, and on pipe coverings, blocks, lagging and cement.

No. 2732. MAGNETIC SWITCHES: General Electric Co., 1 River Rd., Schenectady, N. Y. 4 p. bulletin (No. GEA-1587C) on combination magnetic switches for full voltage starting of induction motors.

No. 2733. MOTORS: Bodine Electric Co., 2254 W. Ohio St., Chicago, Ill. 8 p. bulletin (No. 1020-A) on fractional horsepower motors from 1/2000 to 1/6 hp.

No. 2734. MOTORS: General Electric Co., 1 River Rd., Schenectady, N. Y. 4 p. bulletin (No. GEA-2627) on split phase and capacitor motors for belt driven blowers on air conditioners.

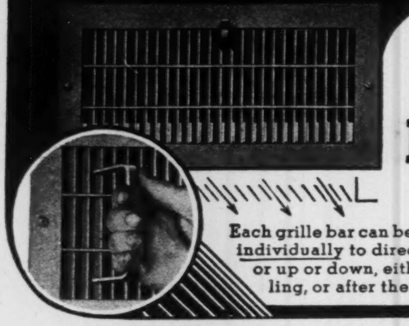
No. 2735. MOTOR INSPECTION: General Electric Co., 1 River Rd., Schenectady, N. Y. 4 p. bulletin (No. GEA-2011A) on portable electric indicating instruments for checking and inspecting motors and lighting circuits in industrial plants.

No. 2736. PRESSURE VESSELS AND PIPING: A. O. Smith Corp., Milwaukee, Wis. Reprint of paper on "Strength and Design of Covers and Flanges for Pressure Vessels and Piping," presented before annual meeting of the A.S.M.E. and published in HEATING, PIPING AND AIR CONDITIONING.

No. 2737. PUMPS: Deming Co., 14 Aetna St., Salem, Ohio. 4 p. bulletin (No. 3000) on self priming centrifugal pumps for handling 600 to 20,000 gph.

No. 2738. PUSH BUTTON STATIONS: General Electric Co., 1 River Rd., Schenectady, N. Y. 12 p. bulletin (No. GEA-2473) on push button stations and other manual electrical controls for use in control circuits of magnetic controllers.

No. 2739. RADIATION: Crane Co., 836 S. Michigan Ave., Chicago, Ill. 8 p. bulletin with ratings and dimensions of direct



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DIRECTED AIR FLOW
REGISTERS and GRILLES

Each grille bar can be set individually to direct air flows right or left or up or down, either at the time of installing, or after the system is in operation.

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Dependable

Dependability is inherent in the design of TORRINGTON Blower Wheels. Made of a special aluminum alloy which combines strength and light weight, these wheels resist corrosion, start quicker, and save power. The unique patented construction breaks up resonance and minimizes noise.

Single and double unit wheels available in sizes 3" to 15" diameter in all standard widths. Write for bulletins.

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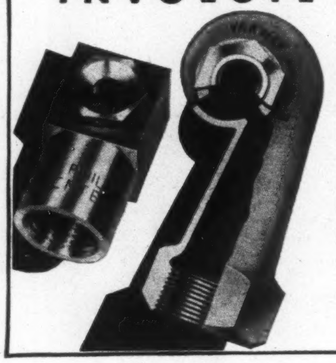

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Made in sizes and types for all requirements. Ask for Bulletin N-615.

YARNALL-WARING CO., PHILA.
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More and Cleaner Pipe Cuts per cutter blade

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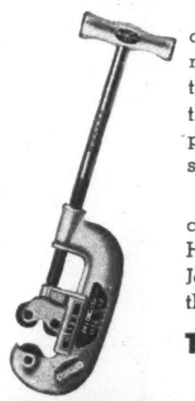
Your experience with pipe tools makes it easy for you to see at once why this patented RIDGID Cutter saves you money on cutter wheels and gives you far cleaner cuts.



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... That will test hydrostatically without damage up to 75 lbs.
... and has heavy wall helically corrugated bellows—rugged and durable.
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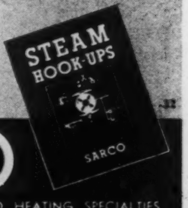

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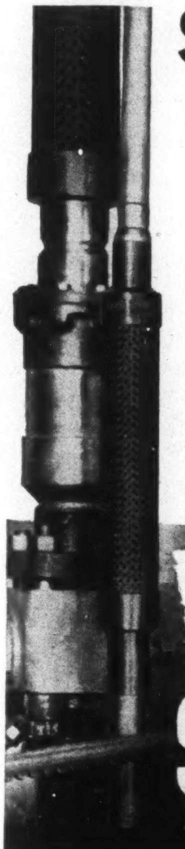

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Rex Vibra-Sorbers absorb vibration, stop noise, insure permanently quiet operation. Sweated into the compressor lines, they act as flexible couplings for speedy, trouble-free installation. All sizes available.

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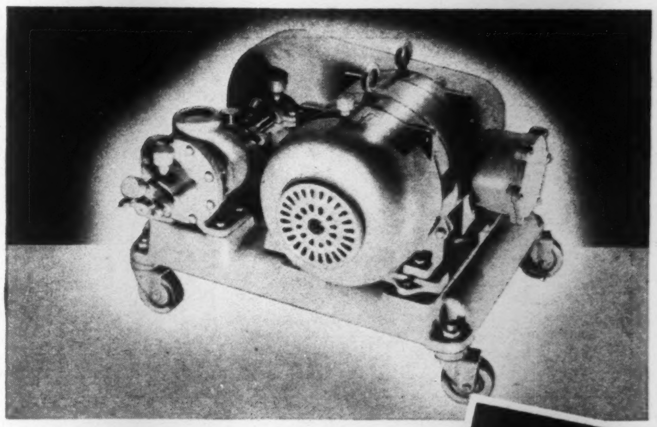

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Sizes 10 to 100 GPM in various metal constructions to handle practically anything that flows. **Write for Bulletin UB350.**

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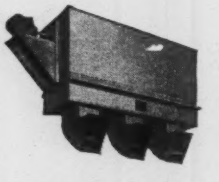

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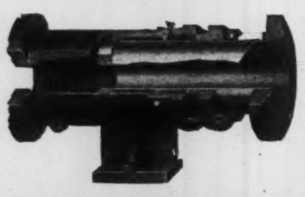

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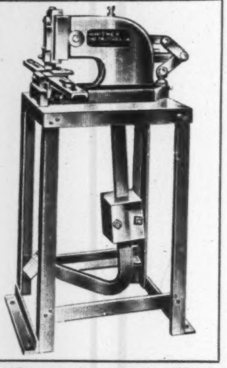

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2720	2721	2722	2723	2724	2725	2726
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radiators, shielded radiators, invisible shields, convectors and enclosures, valves, fittings and accessories.

No. 2740. REFRIGERATION TOOLS: Bonney Forge & Tool Works, Tilghman St. & Meadow St., Allentown, Pa. 28 p. catalog (No. 38R) on tools for refrigeration service, illustrating and describing a complete line.

No. 2741. RELAYS, TIMERS AND THERMOSTATS: Struthers Dunn, Inc., 139 N. Juniper St., Philadelphia, Pa. 32 p. technical catalog (No. D) thoroughly treating relays, timers and thermostats.

No. 2742. ROOM COOLERS: Governair Corp., 605 W. Main St., Oklahoma City, Okla. Data sheet on new self-contained room cooler available in ½, ¾ and 1 hp sizes.

No. 2743. SCREWS: American Screw Co., Providence, R. I. 6 p. bulletin on "Phillips" recessed head screws, illustrating and describing features and advantages.

No. 2744. SOLENOID OPERATED VALVES: General Electric Co., 1 River Rd., Schenectady, N. Y. Data sheet (No. GEA-1423A) on solenoid operated valves, describing and illustrating features.

No. 2745. STEAM JET EJECTORS: Ingersoll-Rand Co., 11 Broadway, New York, N. Y. 28 p. bulletin (No. 9046) on single, two, and three stage steam jet ejectors for removing air, gas or vapors from condensers and vacuum chambers in industrial processes.

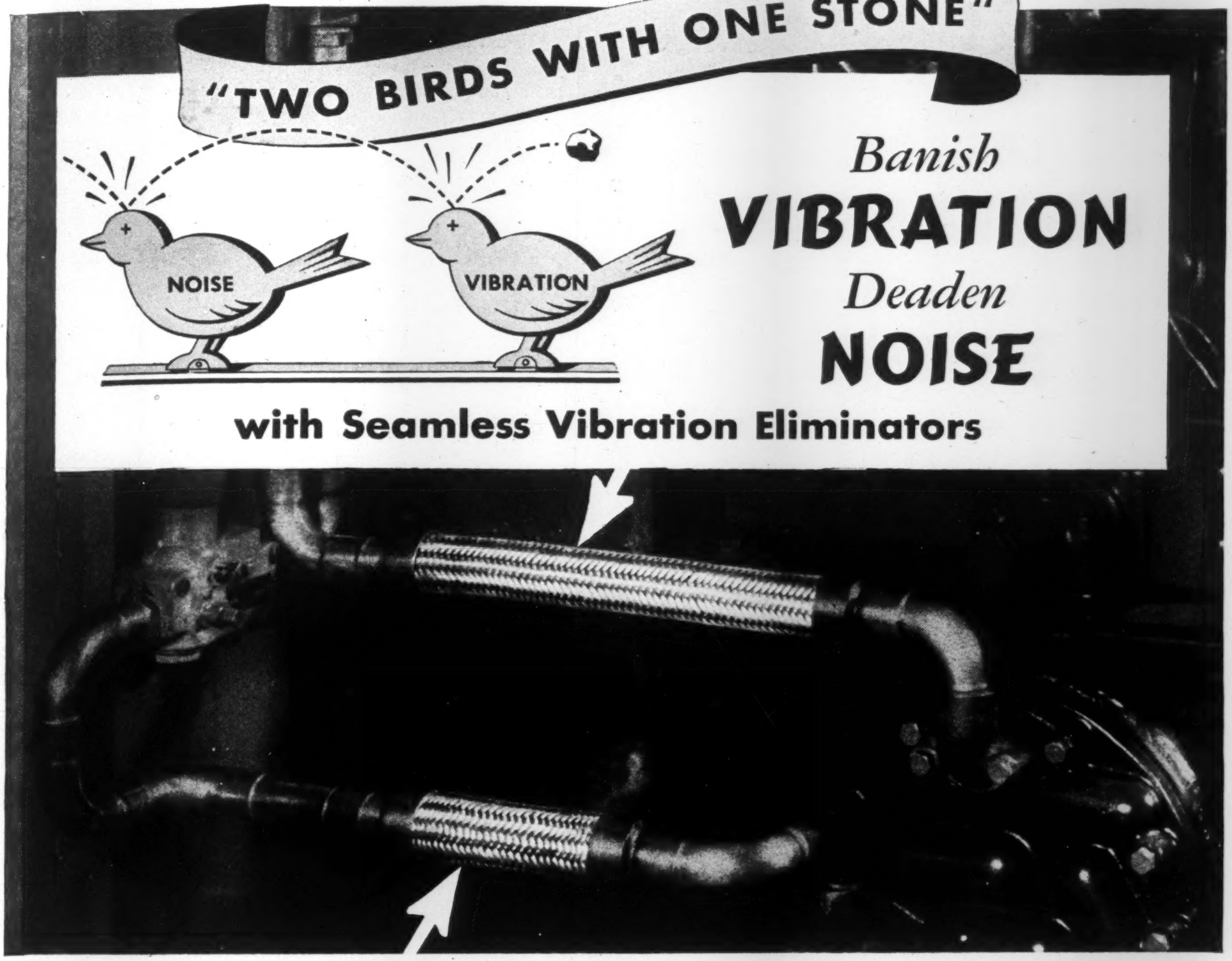
No. 2746. VALVES AND FITTINGS: Walworth Co., 60 E. 42nd St., New York, N. Y. Issue of "Walworth Today" (Vol. 1, No. 5), including information on cast steel for valves and fittings.

No. 2747. VALVES: Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn. 8 p. bulletin (No. 4-4500) on bronze valves with hardened stainless steel seats and discs of 500 Brinnell.

No. 2748. V-BELTS: B. F. Goodrich Co., 548 S. Main St., Akron, Ohio. 140 p. pocket size v-belt data book with belt numbers, dimensions, list prices, models, makes and part numbers. Also 16 p. v-belt conversion list to quickly find "Goodrich" belt that can be interchanged with belts of other manufacturers.

No. 2749. WATER HEATERS: Sims Co., 18th and Whitley Sts., Erie, Pa. Folder illustrating and describing storage type water heaters, heat economizers, heat exchangers, feed water heaters, steam separators, fuel oil heaters, unit pulverizers, etc.

No. 2750. WATER TREATMENT: Water Service Laboratories, Inc., 423 W. 126th St., New York, N. Y. Data sheet on cracked sections and pitted tubes in heating boilers, and prevention or minimizing of injurious effects by chemical treatment of the feed water.



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with Seamless Vibration Eliminators

Do away with these two enemies of refrigerant lines by using American Vibration Eliminators

INSTALLING American Vibration Eliminators in the liquid and suction lines of air-conditioning equipment is the one sure way to put an end to the noise and vibration problem. These units are made from *FLEXIBLE* SEAMLESS BRONZE tubing. Since they are *Flexible* they readily isolate compressor vibration and prevent the transmission of noise along rigid pipe lines. Since they are *Seamless* they cannot leak. Since they are true *Bronze* they are non-corrodible by the common refrigerants such as freon or methyl chloride.

Thousands of installations of American Vibration Eliminators have proved their ability to stand the greatest test of all—actual service in the field. Leading air-conditioning manufacturers are incorporating these units as standard parts on their machinery. Contractors, installers, consulting and service engineers are recommending American Vibration Eliminators as the best insurance obtainable against noise and vibration.

Stocked with leading supply dealers, American Vibration Eliminators are obtainable to fit over copper water tube or into solder fittings in sizes up to 3" I.D. They come to you thoroughly clean and sealed with moisture-proof, dirt-proof caps.

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Equipment Developments

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Polyspeed Alternating Current Motors Developed

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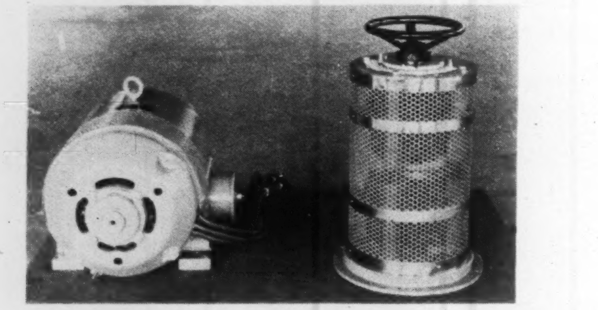

The polyspeed motor has a laminated stator core with a winding similar to that of a three phase induction motor. The changes in speed are controlled electrically by a speed regulator by which a "bucking voltage" is applied to the motor brushes, as the speed of the motor depends upon the voltage applied to the brushes. By this means, the speed control is wholly continuous to obtain any speed between a minimum slightly above standstill up to a maximum of about 1800 rpm.

As the motor operates at practically constant field, the torque—which is approximately proportional to the product of the field strength and the armature current—is constant for all speeds. The horsepower output is directly proportional to the speed. It is possible in some cases to operate the motor at increased torque at the higher speeds because of the greater effectiveness of the fan which cools the motor; advantage can be taken of this when driving such loads as fans and centrifugal pumps which require higher torques at the higher speeds.

The speed regulator, being separate from the motor, can be mounted in the position most handy for the operator. In many cases the speed regulation can be made automatic.—Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.

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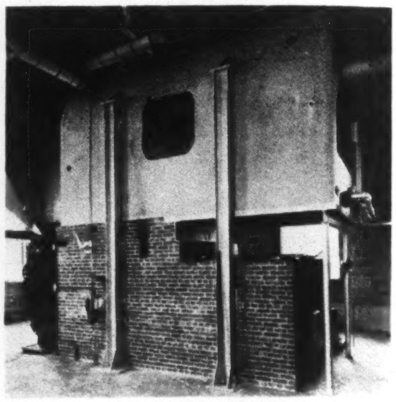
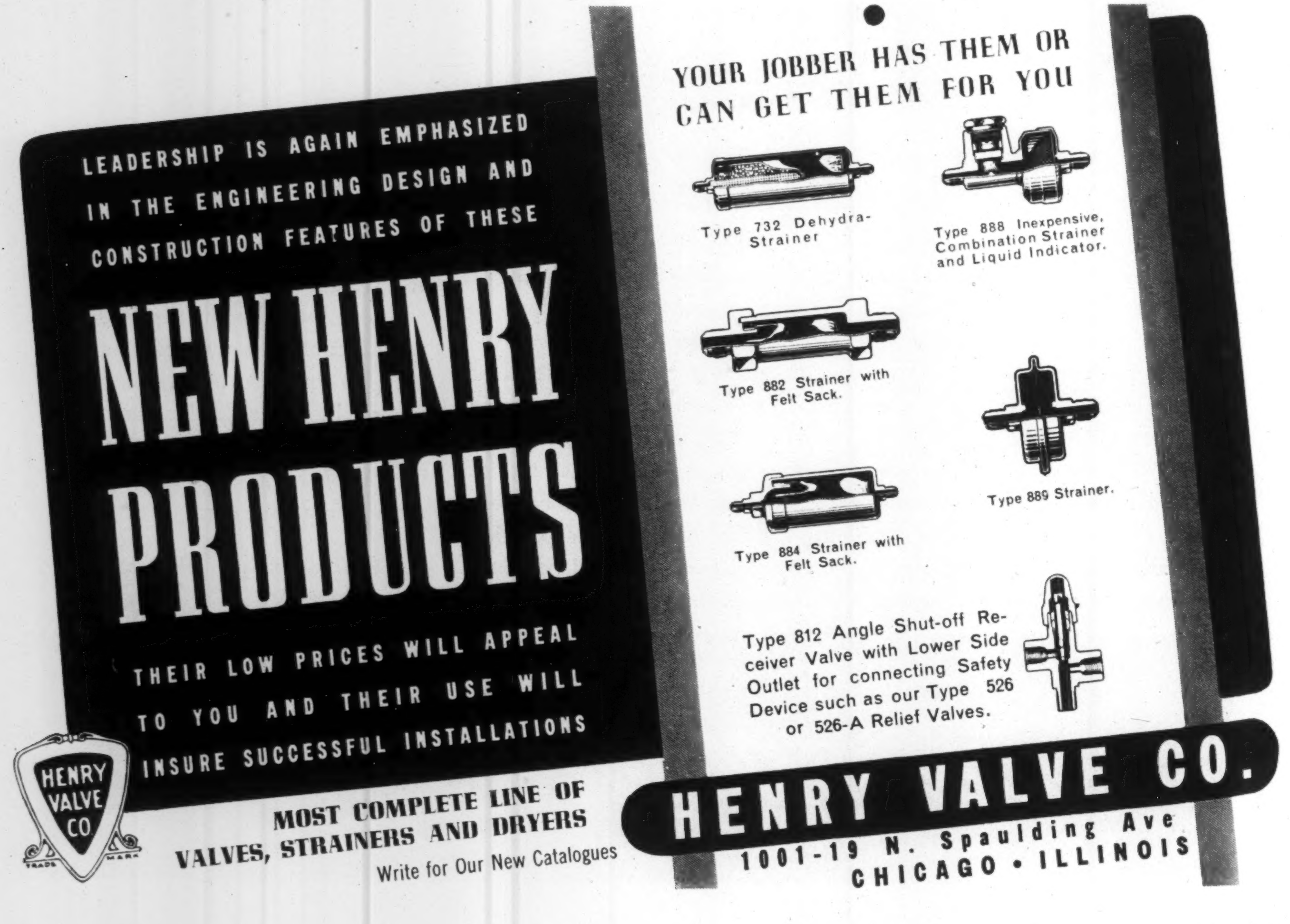


No. 1455—Feature of the new "Fuel-Saver" water tube boiler is that it is shipped as a fully assembled compact unit, ready for service. Of all-steel construction, it is available for 100, 125, and 150 lb steam working pressure and is offered for use in hospitals, hotels, laundries, dairies, institutions, manufacturing plants, and for furnishing process steam for all purposes.

The steel walls of



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Type 888 Inexpensive, Combination Strainer and Liquid Indicator.

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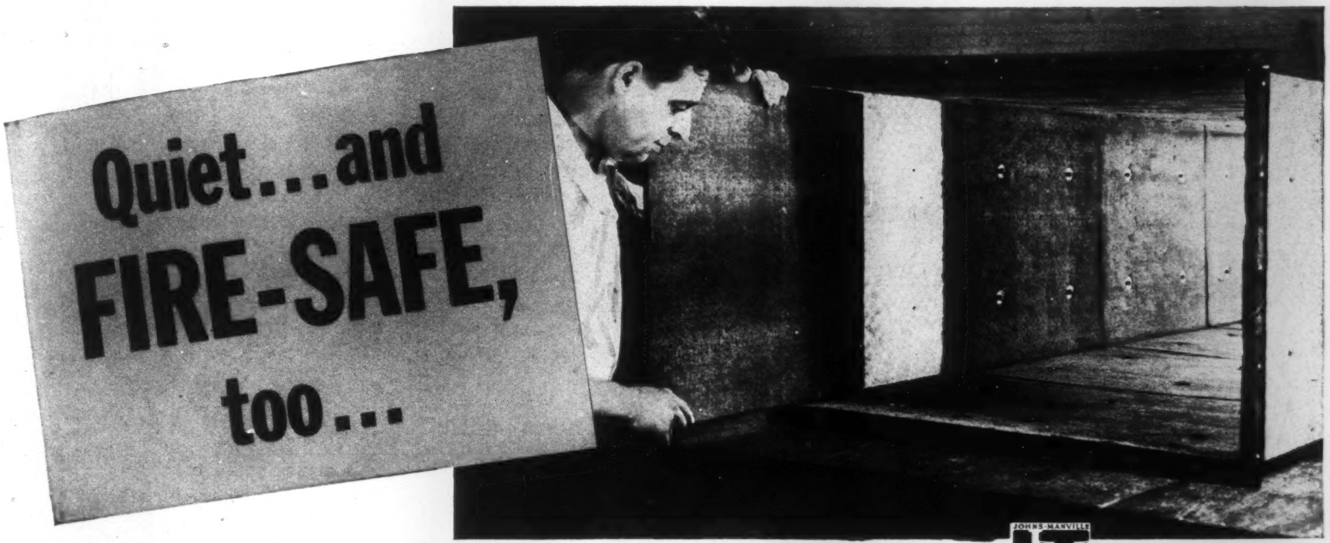


No SMALL MATTER, the additional factor of fire-safety . . . when lining air-conditioning ducts for sound absorption! Bulletins from the National Board of Fire Underwriters report cases where expensive damage was caused by the absence of this protection.

To make sure *your* air-conditioning ducts will never contribute to fire spread, line them with Johns-Manville Airacoustic Sheets. This material has a rate of sound absorption as high as 80% . . . and provides a high degree of fire-safety as well.

Moreover, J-M Airacoustic Sheets provide many other advantages. Permanence, by virtue of their mineral composition . . . resistance to moisture . . . low thermal conductivity . . . light weight . . . and a smooth surface that means low frictional resistance.

For complete details on J-M Airacoustic Sheets, write Johns-Manville, 22 E. 40th St., New York, N. Y.

JOHNS-MANVILLE PRODUCTS JM

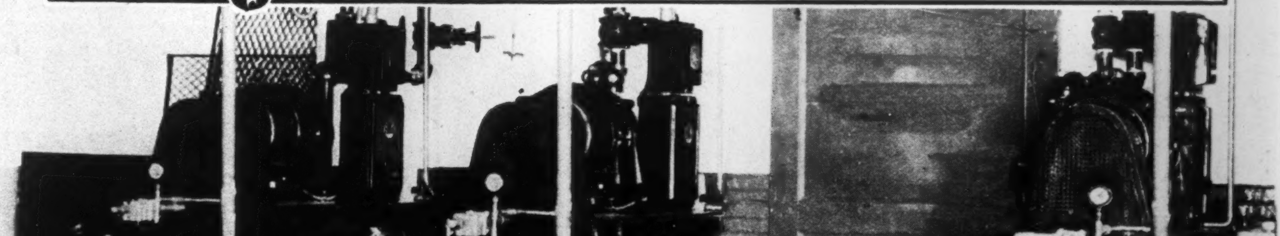
JOHNS-MANVILLE

AIRACOUSTIC SHEETS

For Duct Lining

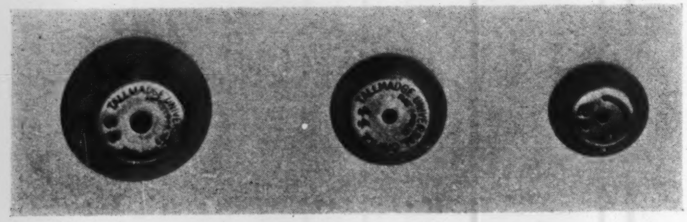
TRADE FRICK MARK **Air Conditioning** **Refrigeration**

Either way you take it, Frick Air Conditioning or Frick Refrigeration offers you the value of 56 years experience, the country's best trained corps of sales engineers, as well as machines, like those illustrated, of the most advanced design. Ammonia, carbon dioxide, methyl chloride and Freon-12 systems. Write for recommendations now.



DEPENDABLE REFRIGERATION SINCE 1882
FRICK Co.
WAYNESBORO, PENNA. U.S.A.

TALLMADGE
Zoned Controlled
HEATING



An ORIFICE machined with unusual precision (the size depending on the capacity of the radiator) allowing a controlled amount of steam to enter the radiator is an essential part of Tallmadge Zoned Heating.

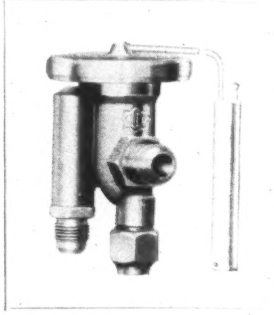
BETTER HEATING AT LESS COST
GIVES GREATER COMFORT
Improves Air Conditioning
WEBSTER TALLMADGE & CO.
NEW YORK CITY

the boiler are entirely water backed and no brickwork is required. Thus additional heating surface is provided and furnace wall repair cost is eliminated, according to the manufacturer, who lists the following additional construction and performance advantages: Quick steaming, maximum heat absorption, unusual overload capacity, easy to keep clean and to maintain, abundant water content and steam space, greatest horsepower for given space, ends of all tubes water cooled, no bent tubes (which facilitates replacement), crown far removed from fire, and large proportion of prime heating surface.

The unit illustrated is a 200 hp boiler operating at 200 per cent of rating at 100 lb working pressure, fired with a chain grate stoker. It is available in a range of capacities from 5 to 300 boiler hp.—International Boiler Works Co., East Stroudsburg, Pa.

Thermostatic Expansion Valve for Small Capacities

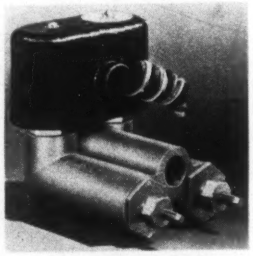
No. 1456—Illustrated is a new small capacity thermostatic expansion valve recently announced which is light in weight and small in overall dimensions. At 60 lb pressure difference between valve inlet and outlet, models available for "Freon" service have capacities of 0.30, 0.60, 1.15, and 2.50 tons, and those for methyl chloride service have capacities of 0.30, 0.60, 2.30, and 5.00 tons.



According to the manufacturer, the all metal construction and the welded power assembly provide a sturdy valve which can be installed and mounted without danger of damage. The stainless spring steel diaphragm and the metal housing are welded together to form one piece of metal, and the diaphragm construction is such that the maximum strain of motion is at a point remote from the weld. Adequate filter area is incorporated to protect against plugging, the maker states.—Alco Valve Co., Inc., 26 Big Bend Blvd., St. Louis, Mo.

Announces Magnetic Valve, Pilot Control

No. 1457—A new dual packless magnetic valve for high-low fire or high-low flow control has two electrically independent solenoids operating two lever action, high pressure valves. Flow adjustments are provided on both ports.



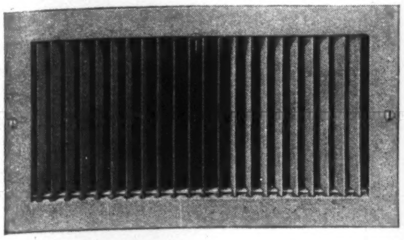
GENERAL CONTROLS

The lever action develops six times the opening and closing power of straight magnetic valves, says the maker, and thus will handle oils as heavy as No. 6 at usual room temperatures or steam up to 125 lb pressure—temperature up to 400 F.

Energy consumption is 14 watts per solenoid.

The same manufacturer has also announced the "Thermopilot," a new automatic pilot control, utilizing the thermocouple principle. When the flame is applied to the thermocouple element, contact is made, allowing the main gas valve to open. Should the pilot light fail, the device automatically opens the circuit and the gas valve closes. It automatically resets itself when the pilot is relighted.—General Controls Co., 450 E. Ohio St., Chicago, Ill.

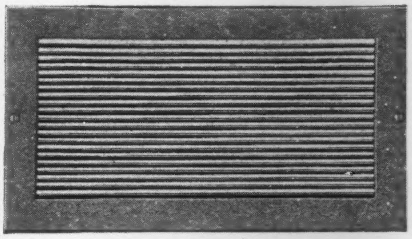
A Line That Covers ALL *Register Needs!*



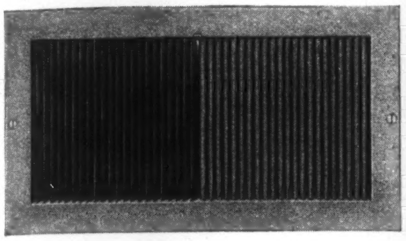
No. 8130—Dura-Flo Register

- A wide choice of models for gravity and air conditioning purposes—plus 15 grille faces.
- Registers and intakes for floor, baseboard, or wall—band or slide frame, standard or narrow mesh.
- Air directing types, single or multiple directions, for any desired effect, fixed or adjustable blades.
- A *Complete Line* that fills *any* requirements as to style, size or finish.

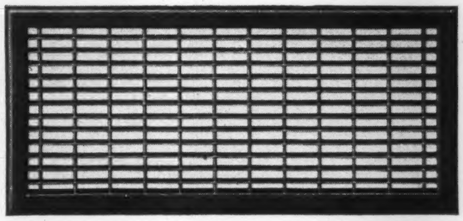
New Catalog 38 shows all latest Auer Models—get your copy now!



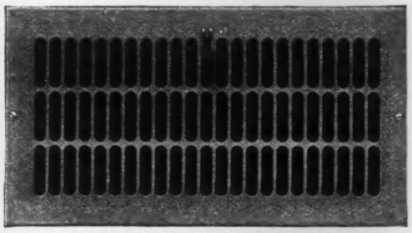
No. 9000—Fin-Flo Register



No. 9030—Fin-Flo Register



Dura Bilt Intake



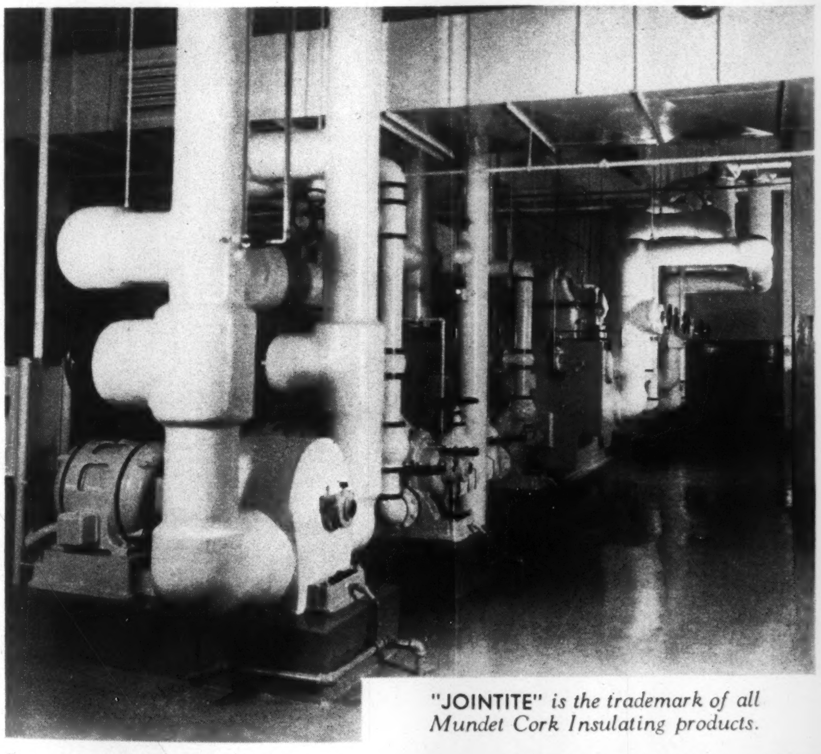
No. 6032—Classic Register

THE AUER REGISTER COMPANY, 3608 PAYNE AVENUE, CLEVELAND, OHIO

AUER DISTINCTIVE REGISTERS

& GRILLES For Air Conditioning *and* Gravity

MUNDET CORK INSULATION



"JOINTITE" *is the trademark of all Mundet Cork Insulating products.*

This neat installation is in the W. C. Stripling Building, Ft. Worth, Texas. All cork insulation for the air conditioning of this building was supplied by Mundet. View shows pipe lines and pump insulated with Mundet Cork Pipe Covering (canvas finish).

LOWERS AIR CONDITIONING COSTS . . . . . .

Mundet Corkboard and Moulded Cork Pipe Covering provide a natural and permanent barrier to heat flow. Their high efficiency permits air conditioning users to enjoy the comforts and economy of precise temperature control. In air conditioning, as in commercial refrigeration, this 100% pure Cork insulation soon pays for itself.

Our engineering department will assist you with specification details and recommendations covering Cork insulation. See our complete Catalog in Sweets or write for individual copy.

SOLVE VIBRATION TROUBLES

with Mundet Natural Cork Mats. This is a most efficient way to isolate machinery vibration. Full particulars on request.

MUNDET CORK CORPORATION
INSULATION DIVISION

65 South 11th Street, Brooklyn, N. Y.
Offices in Principal Cities

about VILTER air conditioning

. FOX MIDWEST SAYS . . .

"After making a complete survey of the Vilter installations installed this year, am glad to advise you that we are more than pleased with the installations as they are performing much better than any equipment we have installed throughout this division."

Very truly yours.

FOX MIDWEST AGENCY CORP.

L. E. Pope

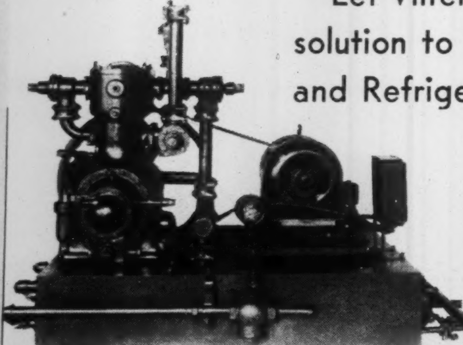
Purchasing Agent

Grand Theatre,
Fox Midwest Agency Corp.
Topeka, Kansas.
F. E. Gross, Consulting Engineer
Capacity 100 Tons.

During the early spring of 1937, Vilter installed Air Conditioning systems in eight Fox Theatres in the vicinity of Kansas City, Missouri. Mr. L. E. Pope, Purchasing Agent for Fox Midwest Division Office, located at Kansas City, watched these installations carefully throughout the summer. His remarks are an extraordinary tribute to Vilter engineering efficiency.

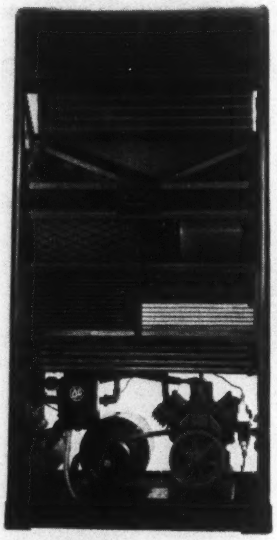
Air Conditioning, "Comfort Cooling" is only as effective and profitable as the equipment used on the installation. Vilter Air Conditioning and Refrigeration equipment is famous for dependability—for truly modern efficiency and economy in operation.

Let Vilter show you a profitable solution to your Air Conditioning and Refrigeration needs.



Superior Since 1867
VILTER
Air Conditioning
Refrigeration . . .

THE VILTER MANUFACTURING COMPANY
2124 SOUTH FIRST STREET, MILWAUKEE, WISCONSIN.



Self Contained Air Conditioners Save Space

No. 1458—New low cost, self contained, package type air conditioning units were announced last month. They come in two sizes, 3 and 5 tons, and are suitable for stores, shops and offices.

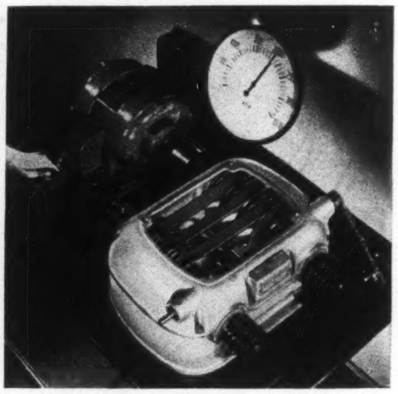
The 3 ton cabinet takes up only 4½ sq ft and the 5 ton, sq ft of space or the equivalent of that occupied by two ordinary office chairs, the maker states. The mechanism is completely contained within 37 cu ft and 49 cu ft respectively. The old 0.9 ton unit required 5 sq ft and 34 cu ft.

The water cooled units require only three connections and can be installed within a few hours. The 3 ton unit delivers 1100 cfm of air and the 5 ton 1460. A feature is the adaptable outlets and louvers for selective air delivery to suit requirements. With these new outlets, air can be discharged to entire interior from front, back, either side, upward, downward, concentrated or spread. Thus the unit can be placed wherever space is available.

The maker also has announced a new portable summer air conditioner with 10 new engineering features. It actually builds pressure in the room, according to the announcement. Through this development, the unit under normal operation admits a larger quantity of outside air and builds a pressure slightly in excess of the adjoining room or outside hall. This provides added ventilation facilities for elimination of smoke and odors.—Carrier Corp., Syracuse, N. Y.

Variable Speed Transmission Unit Offered

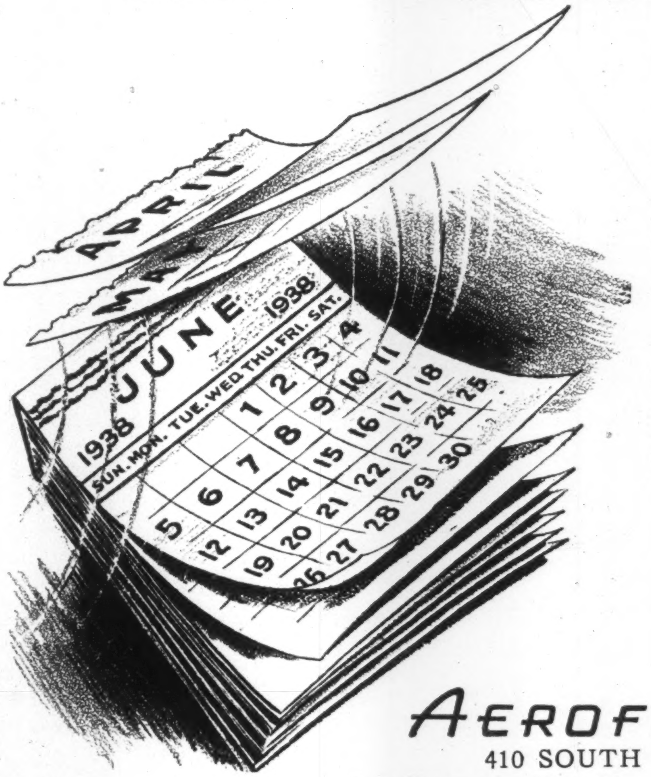
No. 1459—A new "Speed Changer" unit said to open up new horizons in variable speed transmission utilizes the principle of the maker's multi-groove "Vari-Pitch" sheaves.



It consists of a ruggedly constructed, compact, totally enclosed unit, designed with double shaft extensions and driven from a standard motor. Where the change in speed is to be adjusted manually only, the unit is provided with a hand wheel control. However, the unit can be equipped for electric remote control, and manual remote control is also possible.

The range of capacities now being offered includes ratings up to 33 hp with ratios as high as 3¾ to 1. It is expected that larger ratings will be developed in the future.—Allis-Chalmers Mfg. Co., Texrope Div., Milwaukee, Wis.

Hot Weather Ahead!



For Your Information —

Aerofin Cooling Surface has the following important advantages —

Direct Expansion Units with their patented centrifugal headers assuring rapid and equal distribution of refrigerant throughout —

Cleanable Tube Water Units with removable headers permitting easy cleaning of tube interiors where necessary — and —

Continuous Tube Water Units with positive counterflow of air and water —

All of which means lasting satisfaction to the user.

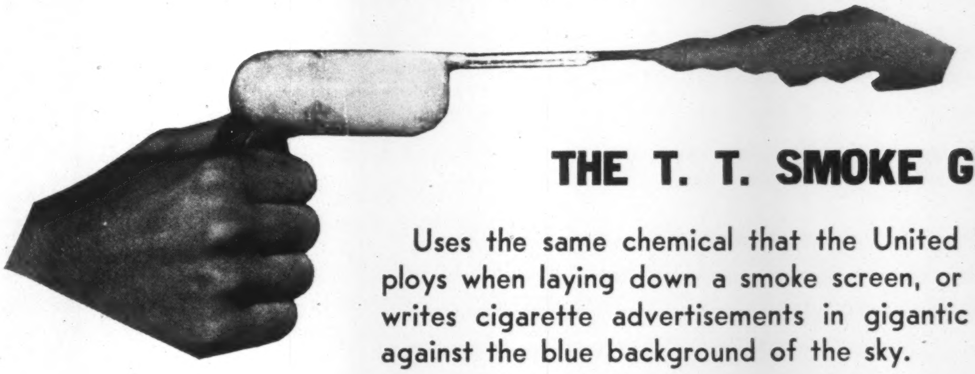
In addition to the above Aerofin's complete line of heating units for all temperatures and pressures, is further assurance that every requirement in the heating and cooling industry can be met.

Write to our home office or consult any of the district offices listed below for complete technical literature or consult them on your specific problems.

AEROFIN
Heat-Exchange Surface

AEROFIN CORPORATION
410 SOUTH GEDDES STREET, SYRACUSE, N. Y.
Chicago • Detroit • New York • Philadelphia • Dallas • Atlanta

A NEW INSTRUMENT OF EXCEPTIONAL MERIT



THE T. T. SMOKE GUN

Uses the same chemical that the United States Navy employs when laying down a smoke screen, or the air pilot who writes cigarette advertisements in gigantic letters of white against the blue background of the sky.

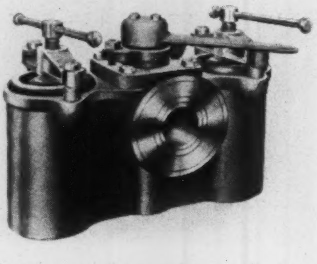
Simple . . . Inexpensive . . . Harmless . . . Valuable in tracing air currents, determining the direction and velocity of air flow, and the general behavior of either warm or cold air in conditioned rooms, etc. Useful and time saving in balancing installations.

PRICE, in suitable carrying case with 3 refill capsules and complete instructions $12.50
(One reloading capsule will produce 1,000 puffs of dense white smoke.)

E. VERNON HILL
179 W. Washington St.—Chicago

Industrial Oil Strainer of Duplex Construction

No. 1460**—The new "Duoflo" suction oil strainer is made of semi-steel and has two perforated baskets held in place by the covers. This duplex construction allows one strainer to be cleaned while the other is in operation. The strainer baskets are large and have a straining area greater than that of the oil intake pipe. Cleaning of one of the strainers is accomplished without interfering with the operation of the system. It is only necessary to turn the plug cock, deflecting the oil through the other strainer, and remove the basket to be cleaned.



These strainers are made in five sizes,—1½, 2, 2½, 3 and 4 in. All suction strainers are flanged, and drilled to American Standard specifications. Each assembly is hydrostatically tested to 150 lb per sq in.

Can be applied to industrial oil burning furnaces, oil processing lines, and, in fact, any place where oil is used as a fuel or in process.—Sheffler-Gross Co., Inc., Drexel Bldg., Philadelphia, Pa.

Units Condition Stores

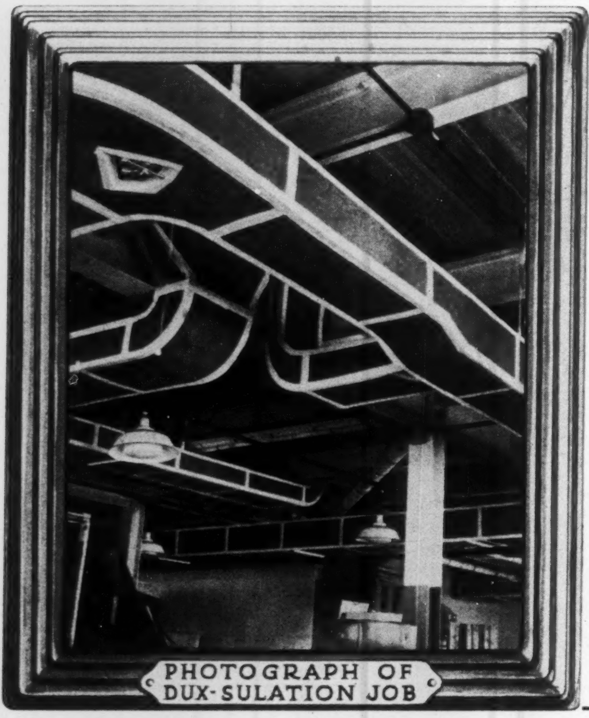
No. 1461—To provide low cost air conditioning for small stores, shops, restaurants, and offices, a new 3 ton unit air conditioner is offered. It has a built in soundproof condensing unit, and does not require duct work. Its weight is about 1100 lb.

The conditioner performs the functions of cooling, dehumidifying, circulating, and filtering air. It may also provide ventilation with the addition of an outside air duct at the time of installation. The unit consists of two independent sections, bolted together—an enclosed condensing unit on top of which is mounted an air conditioner to form an integral assembly.

In operation air is drawn into the unit through a perforated sheet steel grille and about 1275 cfm of air is discharged through louvers at the top. All supply air is filtered by two viscous coated removable glass wool filters at the air inlet.

Either half of the unit may be purchased separately.—General Electric Co., 1 River Rd., Schenectady, N. Y.

COMPARE THE APPEARANCE!



PHOTOGRAPH OF DUX-SULATION JOB

of a Dux-Sulation Job with any other!

A Good Air Conditioning job deserves an attractive insulation—DUX-SULATION will give your job natural and lasting beauty. There are no ugly wires, bolts, nuts, screws or paint daubs to mar the finished appearance and no painting or decorating is necessary—DUX-SULATION comes in an attractive neutral tan patterned finish with a harmoniously colored Tape for the corners and joints.

Combine the beauty of DUX-SULATION with its high insulating efficiency, its effective sound absorption, its Asbestos Protection features and you have the most desired Duct Insulation on the market.

Specify DUX-SULATION and be proud of your jobs.

Dux-Sulation a product of

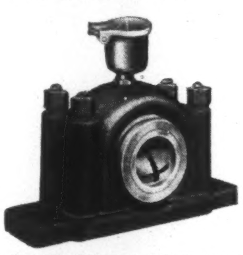
GRANT WILSON, INC.
4109 West Taylor Street Chicago, Illinois

AIR CONDITIONING UTILITIES COMPANY
8 West 40th Street New York, N. Y.

No Bearing Worries with RANDALL PILLOW BLOCKS

* Randall Standard Pillow Block (single reservoir)

* Randall D. R. O. R. Pillow Block (double reservoir)



* Randall Universal Pillow Block (double reservoir). Ball can be turned so that mounting can be made in any of four positions.

* Randall Flange or Side Mount Pillow Block (double reservoir). For mounting on cabinet type air conditioners and unit heaters.

** Shown with large special oiler.*

Many manufacturers of air conditioning equipment have learned that the installation of Randall Pillow Blocks has ended their bearing worries. For Randall Pillow Blocks are exceedingly efficient in operation. They give extra years of service with a minimum of attention and are unusually quiet. Leading manufacturers of air conditioning units have standardized on Randall Pillow Blocks.

They are self-aligning, self-lubricating and made to fine precision standards. All Randall double reservoir Pillow Blocks have the advantage of great reserve oil supply, both reservoirs feeding lubricant to the shaft as needed. (In addition all types can be furnished with large oil cups as shown.)

Randall Pillow Blocks are made in a variety of types and in every needed size. Write for catalog and price list without obligation.

PACIFIC COAST STOCKS

Utility Fan Corp.
Los Angeles, Cal.

C. W. Marwedel
San Francisco, Cal.

EASTERN STOCK

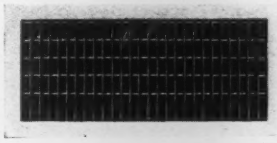
Tek Bearing Co.
177 La Fayette
New York City

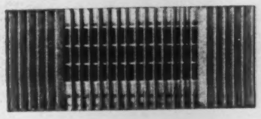
Randall GRAPHITE PRODUCTS CORP.
Dept. 510 609 W. Lake St., Chicago, Ill.

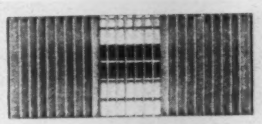
AirMaster

GRILLES

Provide Complete ADJUSTABLE *Volume—Direction—Size* CONTROL







Outstanding feature of the new 1938 AirMaster line is the ACCURATE CONTROL of air distribution which these new units make possible. Completely flexible "Camera Shutter" size control is made possible by a combination of individually adjustable grille bars and damper louvres. Graduated volume control and 4-way direction control permit accurate adjustment to meet requirements of each individual outlet.

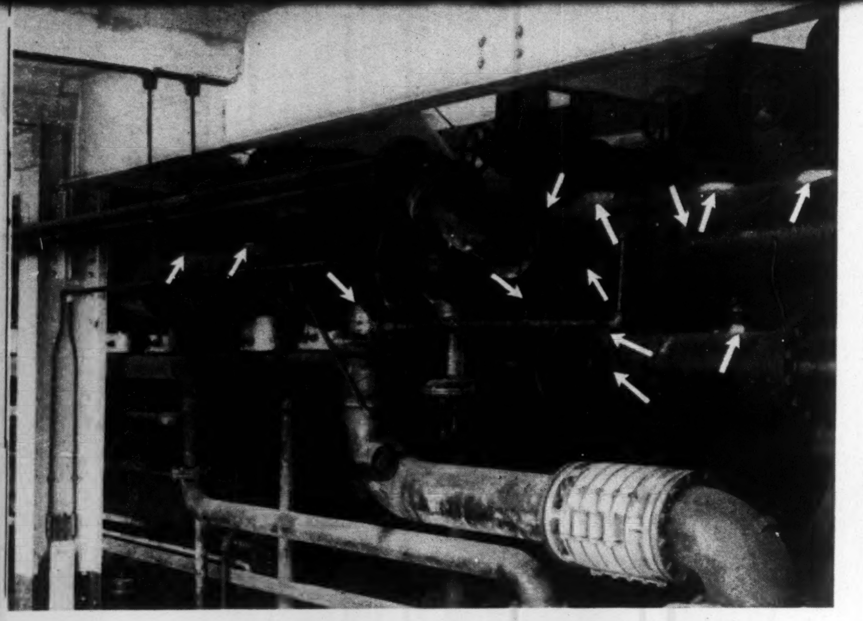
★ Another new AirMaster feature is the "Build Up" Selection Method, made possible by a completely interchangeable line of grilles, dampers and frames.

New 1938 Catalog gives complete details —write for your Free copy today.

WATERLOO REGISTER CO.

Waterloo, Iowa **Seattle, Wash.**

In New York City—Air Conditioning Utilities, 8 W. 40th St.



Complex Piping Installations Simplified With

BONNEY WELDOLETS·THREDOLETS

THE bigger the piping job, the greater the number of branch pipe take-offs—the bigger your savings will be when Bonney WeldOlets and ThredOlets are used.

WeldOlets and ThredOlets are the only welding outlets that eliminate all cutting, threading and fitting of the main pipe. WeldOlets and ThredOlets are the only welding outlets that make branch pipe connections of full pipe strength.

In addition, their funnel-shaped outlets improve free flow conditions and reduce turbulence and friction to a minimum.

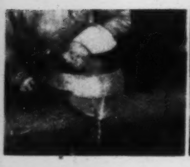
Because of these features and the savings which WeldOlets and ThredOlets make possible, engineers, contractors and others responsible for efficient piping installations have standardized on them when making branch pipe take-offs either for maintenance or new construction.

Improve your next piping job and save with these fittings. Once used, you'll standardize on them.

For full information write for Bulletin WT23 or see your nearest distributor.

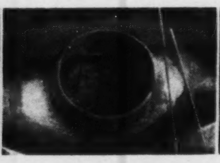
The names "WeldOlets" and "ThredOlets" are Bonney trade marks registered in the United States Patent Office. Full patent coverage for designs, principles and construction has been granted in the United States and foreign countries.

They are easily installed!



Weldolets and
hredolets are
uickly and easily
nstalled. Select the
osition of the outlet
nywhere on the
ain pipe, mark cen-
er lines and tack the
tting into position.

Then weld by electric-arc or oxy-acetylene method. A leak-proof joint of full pipe strength is obtained.



On 2" outlets or larger, the button is removed after installation. A full inspection of the inside of the joint is possible when WeldOlets and ThredOlets are used.

A simple Vee weld is used for attaching the branch when WeldOlets are used. If ThredOlets are used, the branch is screwed into position.

ONNEY FORGE & TOOL WORKS-Allentown, Pa.
WELDOLETS·THREDOLETS
. . . *Welded Outlets for Piping* . . .
Stocked by Leading Distributors

Carbon Steel Wrenches Improved

No. 1462—An improved type of carbon steel wrench is being supplied in a complete line consisting of 50 patterns and more than 1000 sizes. The high strength characteristics of these wrenches are said to result from the fact that they are drop forged from improved quality carbon steel and specially processed to the specifications of the manufacturer.

WILLIAMS
3/4

Other advantages include better hand grip and greater and safer bearing on the nut.—J. H. Williams & Co., 75 Spring St. New York, N. Y.

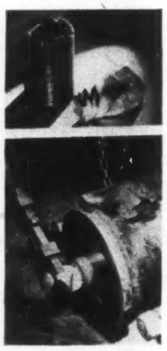
Drop Forged Valves Resist Corrosion

No. 1463—Drop forged steel valves are now available with "Parkerized" valve bonnets, bonnet nuts, packing glands and packing nuts. This rust proofing process eliminates galling of threads due to atmospheric corrosion, thereby making it easy to service the valve and maintain high operating efficiency, according to the maker.

Another feature is the identification disc held in place by the handwheel nut. This disc records the valve size, catalog number, working pressure and temperature, and style of trim, thus making it easy to order proper replacement parts if that should become necessary.—Henry Vogt Machine Co., 10th & Ormsby Sts., Louisville, Ky.

Extracts Broken Pipe and Studs

No. 1464—A new extractor for extracting broken pipe and studs has a patented four point grip to prevent it from reaming and to assure a strong bite without hammering or pounding. Shallow grip lessens any expansion and jamming.



Built-in reamer automatically removes burrs from pipe, eliminating interference with the extractor's bite and minimizes cause for expansion of broken piece. The device pulls rather than reams, says the maker.

The complete set of 10 extractors fits every size and class of pipe, standard, heavy or extra heavy, from 1/8 to 2 in. This same set of tools fits every size of studs, screws and bolts from 7/16 to 3½-in.—Reps Tool Inc., 220 Delaware Ave., Buffalo, N. Y.

Three Ton Conditioner Announced

No. 1465—A new 3 ton capacity self contained air conditioning unit designed especially for retail establishments and other commercial applications of average requirements provides cooling, dehumidification, filtering and air circulation. A heating coil may be added as optional equipment and provision may be made for ventilation by a duct connection.

The unit can be removed and reinstalled in a new location as a unit, with full salvage value. This is particularly desirable for installations on premises held on short term leases, the maker stresses.

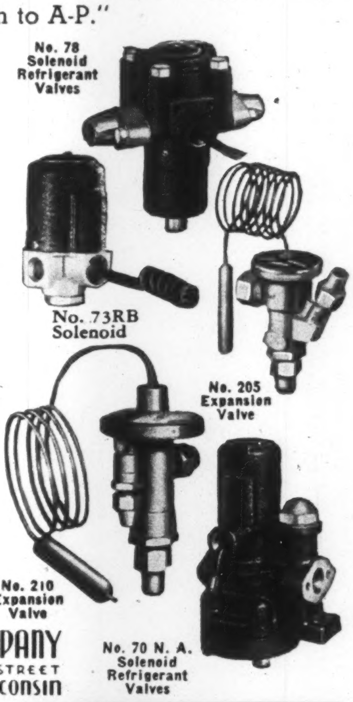
The conditioned air is delivered from an acoustically insulated

CHIEF ENGINEER OF A FAMOUS HOTEL Says . . .

"Every Refrigeration Valve that needs Service here . . is replaced with an A-P Valve . . . . Then . . . . Trouble Stops!"

"Valve Trouble" is one form of Air Conditioning and Refrigeration Service that is very quickly remedied by a "Switch to A-P."

The day-after-day Dependability of A-P Thermostatic Expansion Valves and Solenoids — running into years of satisfactory operation — is one of the main reasons for their enthusiastic acceptance and demand by the Experts of the Industry, Refrigeration Service Engineers, Engineers interested in the maintenance of low cost operation of Refrigeration and Air Conditioning installations, all agree on the superiority of A-P Valves —and demand them from Supply Jobbers. Prove them on your own installations.



No. 78 Solenoid Refrigerant Valves

No. 73RB Solenoid

No. 205 Expansion Valve

No. 210 Expansion Valve

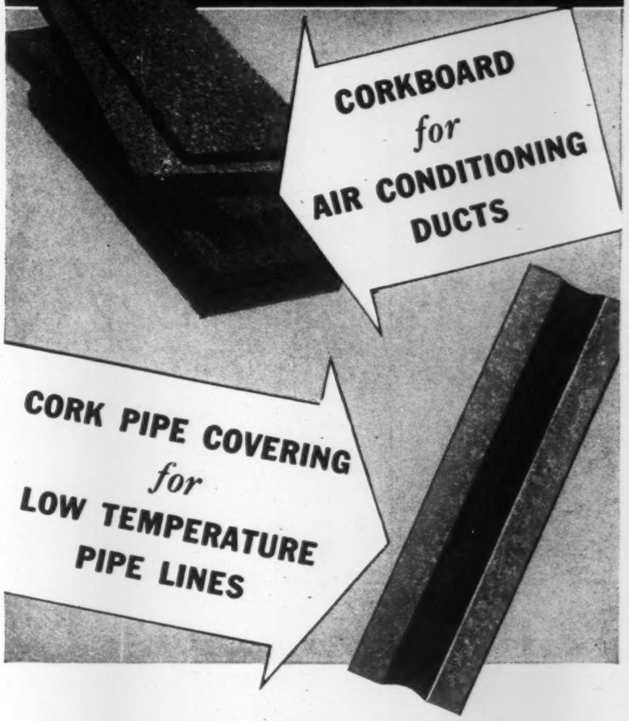
No. 70 N. A. Solenoid Refrigerant Valves

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE WISCONSIN

DEPENDABLE

THE BYWORD FOR A-P CONTROLS

NOVOID CORK INSULATION FOR NEW YORK WORLD'S FAIR BUILDING


CORKBOARD for AIR CONDITIONING DUCTS
CORK PIPE COVERING for LOW TEMPERATURE PIPE LINES

LONG-LASTING INSULATION is now being installed in one of the permanent buildings at the New York World's Fair grounds. In the New York City Exhibition Building, cold air conditioning ducts, attendant air conditioning piping, and low temperature pipe lines, will have the efficient protection of Novoid Cork Insulation.

The unique cell structure of cork, itself, is largely responsible for the long-life, insulating efficiency of Novoid. The millions of tiny air cells of which cork is composed, form an effective barrier to the passage of heat and guard against the infiltration of destructive moisture. Properly installed, Novoid Cork Insulation will assure many extra years of insulating efficiency and economy.

In Corkboard form, Novoid is ideal for insulating round, square, or rectangular cool air ducts of air conditioning systems. It also provides dependable insulation for air-washing rooms. For insulating attendant air conditioning piping and low temperature pipe lines, Novoid Cork Pipe Covering is equally efficient. Let us send you full details of these dependable insulating materials. For your convenience, a coupon is provided below. Cork Import Corporation, 330 West 42nd Street, New York City.

NOVOID CORK INSULATION

MAIL COUPON *for* FULL INFORMATION

Cork Import Corporation,
330 West 42nd Street, N. Y. C.

Please send me full details of Novoid Corkboard and Cork Pipe Covering for insulating, air conditioning, duct work and piping.

Name...

Street...

City and State...

HOME OF COMMUNITY PLATE SILVER CUTS FUEL COSTS 15 P.C.

Webster Moderator System Heats Administration Building of Oneida Community, Ltd.

BETTER STEAM DISTRIBUTION

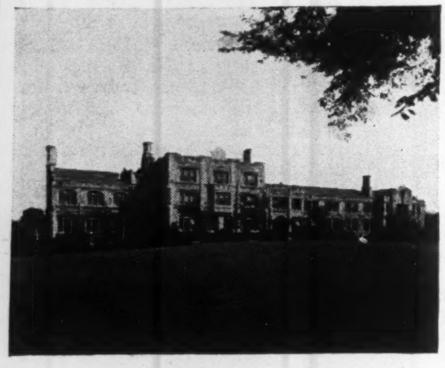
Heating Installation, Adequate When Building Was New, Gives Way to Modern Controls

INCREASED HEATING COMFORT

Sherrill, N. Y.—The makers of world-famed Community Plate Silver reduced fuel consumption 15 per cent in their modern Administration Building by installing a Webster Moderator System of Steam Heating.

The building is heated by gas from the mains of the Utica Gas and Electric Co., the 15 per cent savings figure being based on meter readings.

This substantial increase in heating effectiveness was accomplished in 1937, after a careful survey of the original installation, a Webster Vacuum System with temperature control in individual rooms, had indicated an opportunity for improved heating service.



Administration Building, Oneida Community, Ltd.
Sherrill, N. Y.

With the Webster Moderator System, there has been a noticeable improvement in steam distribution. All sections of the building receive steam at the same time and approximately in accordance with need. An Outdoor Thermostat varies the basic rate of steam delivery with every change in weather conditions. A manual Variator allows the operator to adjust the steam supply to meet special conditions, such as heating-up or reduced night heating load.

There is a total of 9,676 square feet of installed direct radiation.

These before-and-after facts point the way to maximum comfort and economy in heating new buildings as well as in modernization of existing installations. Consult your architect, engineer or heating contractor. Or address

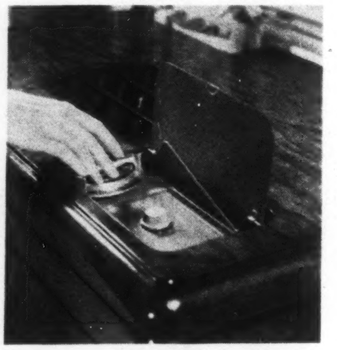
1888 WARREN WEBSTER & CO., CAMDEN, N. J. 1938
Pioneers of Modern Steam Heating
50 YEARS OF HEATING PROGRESS

Representatives in 60 principal U. S. Cities

WEBSTER
MODERATOR
CONTROL
"Control by the weather"

distribution hood at the top of the unit. The outlet is equipped with directional flow grilles to permit distribution of air to fit requirements. A secondary directional grille inside the hood allows adjustment of the horizontal angle of delivery. Where desired, the outlet hood may be omitted and the conditioner connected directly to a duct distribution system. Thermostatic control is provided as standard equipment.

A 3 hp water cooled condensing unit is located in the lower section of the cabinet. The entire unit is carried on a separate frame, isolated from the cabinet by a flexible rubber mounting. A V-belt drive provides power transmission between compressor and motor. The compressor compartment is lined with a blanket of acoustic and heat insulating material. Heat generated in the compartment during operation is removed by a finned water coil, air circulation within the compartment being furnished by a fan built into the compressor flywheel. The upper section of the cabinet contains the filters, evaporator coil and fan.

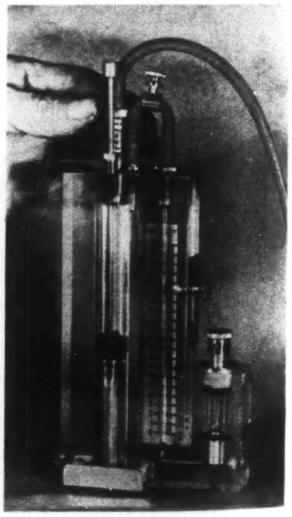


The same manufacturer has also announced a new room cooler embodying the "meter - miser" mechanical principle; a five year protection policy is provided purchasers. — Delco-Frigidaire Conditioning Div., General Motors Sales Corp., 1420 Wisconsin Blvd., Dayton, Ohio.

Carbon Dioxide Analyzer Is Pocket Size

No. 1466**—New pocket CO_2 indicator can be carried in coat pocket, weighs less than 3 lb.

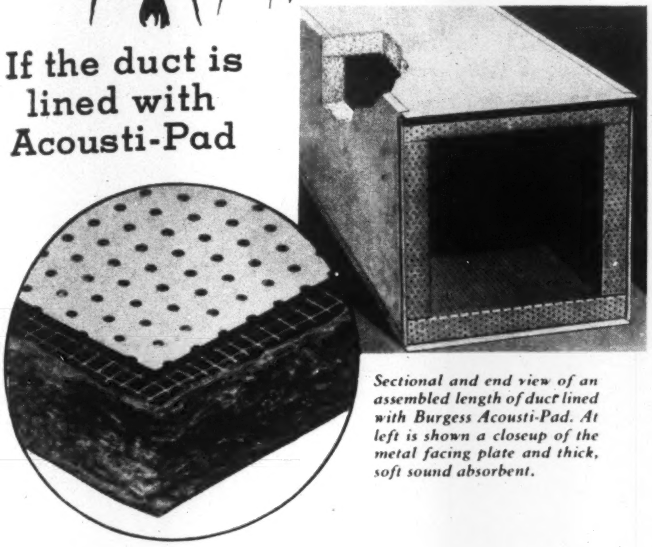
Operation is simple and accurate results are easily obtained in the hands of an inexperienced operator, says the maker. Tests are made while the indicator is held in the hand or in the clip which is provided in the carrying case. The gas sample is pumped in with a dozen strokes of the aspirator bulb while a plunger is held down. The reading is then taken from the mercury column after the absorbing unit has been raised and lowered.



The body of the instrument is made from a new clear and colorless product of the plastics industry that offers advantages over previous materials.—F. W. Dwyer Mfg. Co., 565 W. Washington Blvd., Chicago, Ill.

"Quiet as a falling leaf"

If the duct is lined with Acousti-Pad



Sectional and end view of an assembled length of duct lined with Burgess Acousti-Pad. At left is shown a closeup of the metal facing plate and thick, soft sound absorbent.

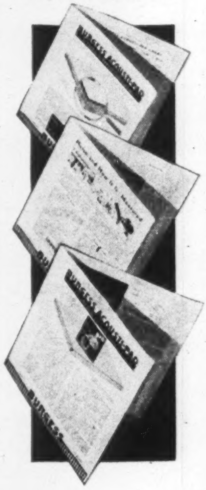
NO SAFER WAY TO *Forestall Duct Noise*

● You know that unexpected duct noise may cause both customer complaints and useless extra expense. It blots up noise like a blotter absorbs ink. This is why Burgess Acousti-Pad is used on so many duct jobs. There is no safer way to prevent duct noise.

You will find Acousti-Pad easy to install. It is applied to ducts as they are fabricated. Other advantages are fire resistance and complete freedom from odors. The smooth metal facing offers no resistance to air flow. By using the Burgess data sheets, you can secure the footage needed direct from a simplified chart.

Prevent any chance of customer complaints. Adopt the safer way of insuring against duct noise. Use Burgess Acousti-Pad on every duct job. Get information on installation methods, prices, and source of supply. Write to us. Ask for the Duct Quieting Bulletins.

Write for Bulletins



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500 W. Huron St., Chicago, Ill.
In England—
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Barwell, Leicester

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BURGESS ACOUSTI-PAD

FOR ABSORBING DUCT NOISES
IN AIR CONDITIONING SYSTEMS

LATEST DEVELOPMENT IN MOTOR ENGINEERING . . .

BALDOR
ELECTRIC

GLASS-INSULATED

Baldor leads again.

First, with STREAMCOOLED design. Now — with GLASS insulation.

The STREAMCOOLED design assures safe operating temperatures in smaller, lighter weight motors without sacrificing performance or reliability.

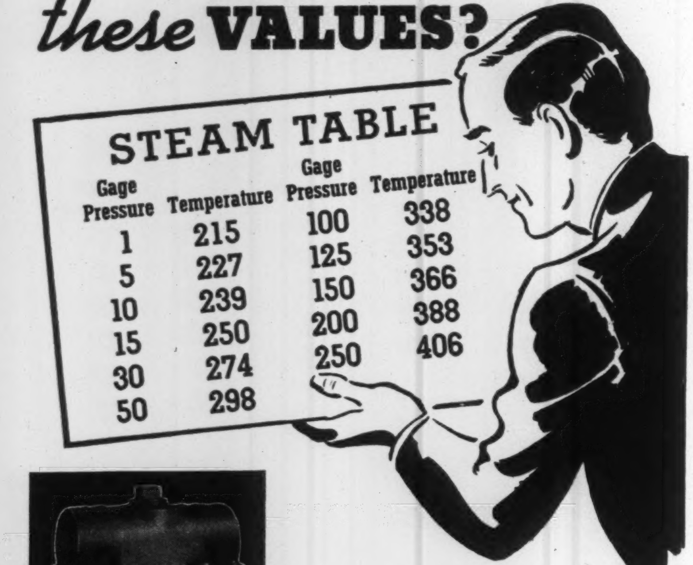
Glass insulation gives greater protection against the hazards of ordinary insulation, and operates safely at 75° C. temperature rise—making even more compact motors practical.

Ask for STREAMCOOLED MOTOR Bulletin No. 200 for full information.

BALDOR
BETTER MOTORS

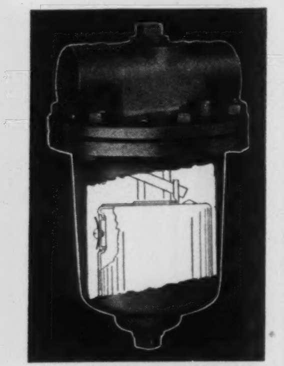
BALDOR ELECTRIC CO. · ST. LOUIS

How **CLOSE DO YOU COME TO** *these* **VALUES?**

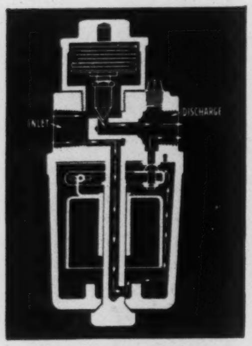


STEAM TABLE

Gage Pressure	Temperature	Gage Pressure	Temperature
1	215	100	338
5	227	125	353
10	239	150	366
15	250	200	388
30	274	250	406
50	298		



Anderson Super-Silvertop Trap with snap action Thermal Air Eliminator. For pressures of two pounds or over.



Anderson Super-Silvertop Combination Inverted Bucket and Thermostatic Trap. For pressures from fraction of an ounce up to 50 pounds.

Do your temperatures on steam using units approach steam table temperatures? Are your temperatures within 2 or 3 degrees of theoretical values or are they 20 or 30 degrees lower? The closer you come to steam table temperatures, the more efficient is your steam system.

The only way to get maximum steam temperatures is to maintain an air free steam system. These air eliminator type Anderson Super-Silvertop steam traps remove all the air and remove it instantly. This means you get instant heat as well as maximum temperatures.

Find out why air elimination saves money—how steam pressures can be lowered—what air elimination can do for you—where air elimination is necessary. Send the coupon below for air elimination data. This data explains the importance of air elimination and is valuable to any steam user. Tear off this coupon and send it in *now*. No cost —no obligation.

THE V. D. ANDERSON CO.
1949 WEST 96th STREET • CLEVELAND, OHIO

You can send me that air elimination data. If it shows me how to save money, I'm interested.

Name.................................... Company....................................
Address.................................... City and State....................................

Humidifying Conditioner Offered

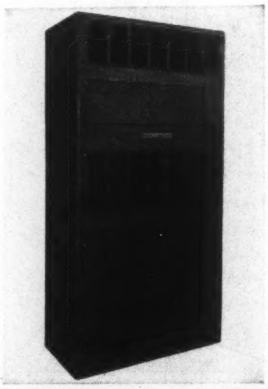
No. 1467—New humidifying conditioner, designed especially for winter comfort, is quiet, efficient, compact, small, light weight, and easy to install, states the maker. It is designed to bring a healthful and comfortable atmosphere to home, office or shop, has a capacity of 300 cfm of air.

The extended surface coil, constructed of tubes expanded to fins, makes a solid, compact one piece unit. Fan and motor assembly is placed on a tubular mounting designed to reduce vibration to a minimum. The target type spray nozzle provides a highly atomized spray of water which is mixed with the air to give proper humidification. The filter is of the throw away pattern.

This conditioner is connected to the existing heating system (steam or hot water) and to a water supply line and waste line. One supply and one return duct are usually enough, says the maker.—Trane Co., La Crosse, Wis.

Store Conditioning Unit Announced

No. 1468—New unit providing summer air conditioning for small shops, stores and offices is called the "Unitaire". It is compact and wholly self contained in a metal cabinet finished in brown baked crinkle. It will filter, cool, dehumidify, and recirculate the air.



The unit can be located in almost any position within the room to be conditioned, occupying a space, approximately 3 ft wide and 2 ft deep; height 8 ft. It is adapted to winter air conditioning by installation in the cabinet of the heating coil, humidifier, etc.

Comes in two sizes, 2½ and 3½ hp. Motor, compressor and condenser are hermetically sealed.—Westinghouse Electric & Mfg. Co., Mansfield, Ohio.

Book Reviews

Graphic Routes to Greater Profits

["Graphic Routes to Greater Profits," published by the Esterline-Angus Co. (manufacturers of electrical instruments), Indianapolis, Ind. 1st ed. 1938. 320 pp., 8½ x 11 in., bound in brown fabricoid. Price, $3.00.]

This new book on the use of graphic instruments in increasing the productive capacity and efficiency of industry is a volume of experience rather than opinion, for it gives more than 250 case studies, each covering a distinct problem, giving the procedure followed, the graphic charts obtained by means of the instruments, and the solutions reached. Following an introductory section on the high cost of inefficiency, what graphical representation means, and a classification of industrial problems, the case studies are presented under five main divisions—the problems of power, the problems of machines, the problems of processes, the problems of men, and research and special

The Welded Steel Burnham is made in our own separate plant at Geneva, New York. Made in 19 sizes ranging in capacities from 1,800 to 42,500 sq. ft.

The Twin Sectional Cast Iron. Aside from its economy advantages, permits of replacements, without any tear-outs. No part is too big to pass through the average size door. Made in 9 sizes. Rates from 7,850 to 19,450 sq. ft. of E.D.R. Steam Rating. Water from 12,000 to 31,800 sq. ft.

Which Boiler Is *Better* For Burning Oil?

ASK any two groups of five heating engineers that question, and what answer do you get? In one group 3 out of 5 will say cast iron boilers are better. In the other group, 4 out of the 5 will say steel.

Now who is wrong and who right?

Frankly, we take no sides. We make both types of boilers. Our only interest is in helping you engineers to get the one that you feel is best adapted to your particular requirements.

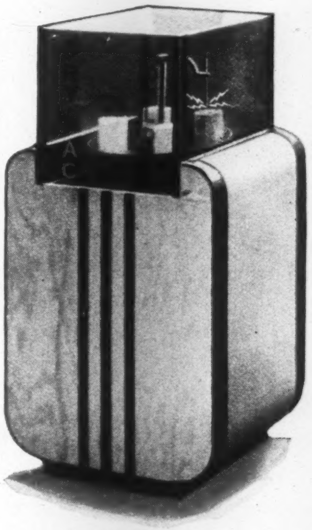
The Cast Iron Twin Section Burnham, the last two years has found much favor, especially on replacement jobs, because it can be installed without any tear-out costs. Any part of the boiler can pass through any average size doorway.

Send for the catalog. Get the full facts on both type boilers.

Burnham Boiler Corporation
Irvington, New York
Zanesville, Ohio

Export Department, 116 Broad Street, New York City

Burnham Boiler



This "DRY-PAC" Test Stand *shows it* STANDS The TEST!

A UNIQUE electric test on Dry-paC Waterproof Asbestos Insulation, made on the device illustrated above, attracted considerable attention at the recent New York Heating & Ventilating Show. Dry-paC, along with 3 other specimens of best grade commercial pipe covering, each 5″ thick, were inserted in this test machine, with the lower portion of each standing in ½″ of water. Excepting Dry-paC, *all absorbed sufficient moisture* to carry electric current, and to produce a visible spark from a rotating terminal of high voltage. The essence of efficiency for underground steam insulation is DRYNESS—*Dry-paC has it!*

Prevent leakage and loss in your steam lines, keep them tight, dry and 90% efficient with a Ric-wiL Tile or Cast Iron System. Ric-wiL service is complete from design to installation and tests. On any sub-soil steam conveyance problem—under-supply, fuel waste, loss in transit—Ric-wiL can give you effective assistance. Write for complete new catalog and Dry-paC test sample.

The Ric-wiL Co., Union Trust Bldg., Cleveland, Ohio
New York San Francisco Chicago
Agents in principal cities

Unlike some other insulations, Dry-paC "stands the weather" —does not deteriorate under action of the elements.

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RIC-WIL

CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

CONTROLS
ANY OIL
THAT FLOWS

* The Series K-10 lever-action magnetic valve has six times the power of straight magnetic valves! Positive opening and tight closing assured on oils as heavy as No. 6 at room temperatures. Also controls water, air, gas or steam up to 125 lbs.

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GENERAL CONTROLS
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STOP the bother of changing Chaser Dies

RIDGID

No. 65R Threads 1" to 2" Pipe with ONE set of Chasers

Instead of 16 chaser dies to lug around, to risk losing, to waste valuable time changing, this threader has only 4 — and they stay in the threader.

A quick shift of the setting post and you're ready to cut perfect threads on 1" to 2" pipe, any metal — a convenience that runs into real money saving.

Like many thousands of users, you go for the new style workholder that clicks to pipe size with a twist of the gauge ring and tightens with one screw. No bushings to bother with.

Plenty of other efficiency features in this rugged modern threader. You get real satisfaction out of owning and using this RIDGID 65R. Try one at your Jobber's—buy it for better, faster, easier threading.

THE RIDGE TOOL CO., ELYRIA, O.

Makers of the Famous RIDGID Wrench

RIDGID PIPE TOOLS

problems. These case studies throughout the 19 chapters are numbered serially and are cross indexed.

Many of the case studies are of direct interest to readers of Heating, Piping and Air Conditioning. Among these are studies on supervising heating systems with graphic records, measuring fuel consumption of an insulated structure, improving operation of exhaust systems, reducing cost of compressed air, studying efficiency of a pump, keeping refrigeration compressors out of step to stagger peak loads, determining expense due to excessive starts of fan and pump motors, testing pumps and compressors, and locating cause of fan motor failures.

Conventions and Expositions

National Fire Protection Association: Annual meeting, May 9-12, Haddon Hall Hotel, Atlantic City, N. J. Headquarters Office, 60 Batterymarch St., Boston, Mass.

Refrigerating Machinery Association: Spring meeting, May 11-12, Hot Springs, Va. Headquarters' Office, Southern Bldg., Washington, D. C.

Air Conditioning Manufacturers' Association: Annual meeting, May 13-14, Hot Springs, Va. Headquarters' Office, 915 Southern Bldg., Washington, D. C.

International Petroleum Exposition: May 14-21, California Bldg., Tulsa, Okla.

American Foundrymen's Association: Annual convention, May 16-19, Public Auditorium, Cleveland, Ohio. Headquarters Office, 222 W. Adams St., Chicago, Ill.

Smoke Prevention Association: Annual convention, May 17-20, Andrew Jackson Hotel, Nashville, Tenn. Display of commercial exhibits and educational exhibit to be held in conjunction. Headquarters' Office, 139 N. Clark St., Chicago, Ill.

Heating, Piping and Air Conditioning Contractors National Association: 1938 convention, May 31-June 2, Boston, Mass. Chairman of Convention Committee, Frank E. Kise. Headquarters Office, 1250 Sixth Ave., New York, N. Y.

National Warm Air Heating and Air Conditioning Association: Mid-year convention, June 13-15, Plankinton Hotel, Milwaukee, Wis. Managing Director, A. W. Williams, 50 W. Broad St., Columbus, Ohio.

American Society of Heating and Ventilating Engineers: Semi-annual meeting, June 20-22, The Homestead, Hot Springs, Va. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

National Association of Building Owners and Managers: Annual convention, June 20-23, Hotel Schroeder, Milwaukee, Wis. Association headquarters, 134 S. LaSalle St., Chicago, Ill.

American Society of Refrigerating Engineers: Food preservation conference, June 20-24, at Pennsylvania State College, sponsored by the A. S. R. E. and a number of universities. Headquarters' Office, 37 W. 39th St., New York, N. Y.

American Society for Testing Materials: Annual meeting, June 27-July 1, Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary-Treasurer, C. L. Warwick, 260 S. Broad St., Philadelphia, Pa.

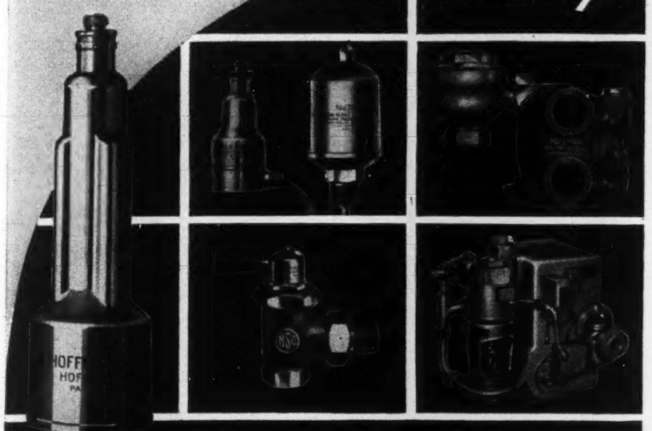
National District Heating Association: Annual convention, June 28-July 1, Lord Baltimore Hotel, Baltimore, Md. Secretary-Treasurer, William H. Sanford, 1317 Spruce St., Philadelphia, Pa.

National Industrial Advertisers Association: Annual conference, September 21-23, Cleveland, Ohio. Committee Chairman, Stanley Knisely, Advertising Manager, Republic Steel Corp., Republic Bldg., Cleveland, Ohio.

American Welding Society: Annual meeting (in conjunction with Metals Congress Exposition), October 17-21, Detroit, Mich. Secretary, M. M. Kelly, 33 W. 39th St., New York, N. Y.

American Public Health Association: Annual meeting, October 25-28, Kansas City, Mo. Headquarters Office, 50 W. 50th St., New York, N. Y.

THIS IS OUR.. *Silver Anniversary*



Celebrating a Quarter Century in the manufacture of quality Heating Specialties, and adherence to a fair selling practice.

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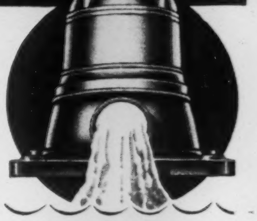
Big Kokomo Steel Mill
NOW HAS 5 LAYNE DEEP WELL UNITS



The Continental Steel Corporation of Kokomo, Indiana, is another of the many careful-buying firms who have chosen Layne Wells and Pumps. Their five large rock wells produce 4,000 gallons of water per minute.

Layne Wells and Pumps are noted for their high efficiency and low upkeep costs. This organization plans, drills, and equips the wells completely. Let us send illustrated literature and more complete details of our services in the field of deep well water production. Address Layne & Bowler, Inc., Dept. K, Memphis, Tenn.

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Layne-Atlantic Co.	Norfolk, Va.
Layne-Central Co.	Memphis, Tenn.
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Layne-New York Co.	New York City.
Layne-Northwest Co.	Milwaukee, Wis.
Layne-Ohio Co.	Columbus, Ohio.
Layne-Texas Co.	Houston, Texas.
Layne-Western Co. Kansas City, Mo. Chicago, Ill., Minneapolis, Minn. and Omaha	Nebraska.
Layne-Bowler New England Company, Boston	Massachusetts.
International Water Supply, Ltd., Fort Erie, N.	Ontario, Canada.

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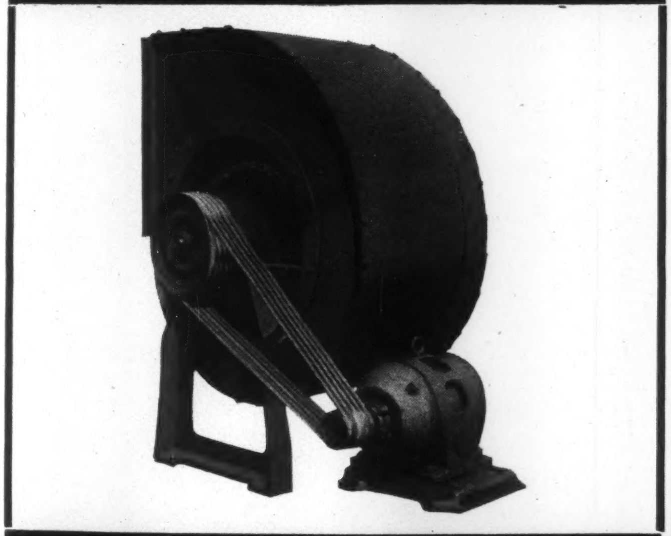
PUMPS & WELL WATER SYSTEMS
FOR MUNICIPALITIES • INDUSTRIES • RAILROADS • MINES AND IRRIGATION

1878 *Sixty Years* EXPERIENCE 1938
FANS & BLOWERS for ALL PURPOSES
Certified Performance
Rugged Dependable Construction
Prompt and Complete Service
LET US HELP SOLVE YOUR AIR PROBLEMS!



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N. A. F. M. Member
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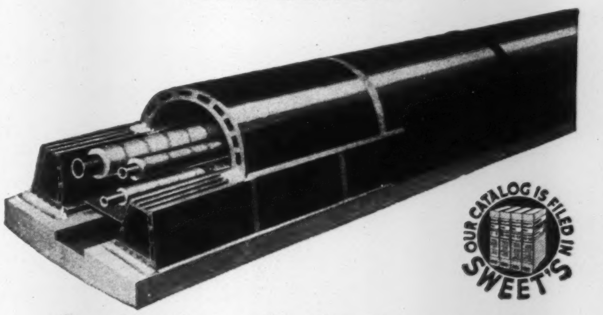
The Conduit for
Underground Steam Lines

Simplest
Strongest
Most Efficient



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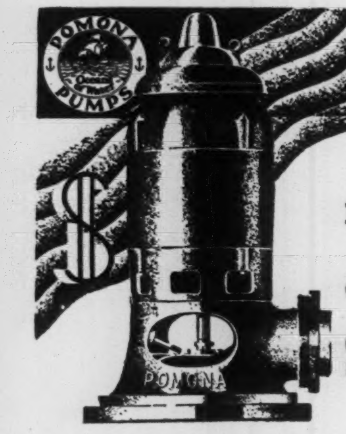

THE FINANCIAL ANGLE OF WATER SERVICE

When you put your money into a pump it's there—for good or bad. Almost any shop can make a pump so that it will work in some way. But owners in the heating and air conditioning industry want pumps that will work in the best possible way for the longest time at the lowest over-all cost. They want to be assured of receiving standardized parts that will fit when needed. That's the financial angle as we see it from the owner's viewpoint.

Engineering and production procedures in Pomona Pump Manufacturing Plants are dictated by this viewpoint. They involve correct design of every detail, the use of the best currently available materials for each specific purpose, adequate and modern plant facilities and expert workmanship.

POMONA PUMP CO.
Manufacturing Plants: Pomona, Calif., St. Louis, Mo.
Branch Offices: New York, Chicago, Los Angeles, San Francisco

POMONA TURBINE PUMPS

ENGINEER'S

Hydron METALLIC BELLOWS
CLIFFORD MANUFACTURING CO.
CHARACTERISTICS AND PROPERTIES
Free
HYDRON

44 Page Data Book

HYDRON Metallic Bellows are used as control elements in temperature-and-pressure-control devices, and for liquid or gas seals of compressors and pumps. We are specialists in the design and production of complete thermostatic and pressure units for temperature and pressure controls. We are, therefore, prepared to extend the fullest cooperation to engineering departments of control manufacturers in the solution of design and engineering problems.

METALLIC BELLOWS

CLIFFORD MANUFACTURING COMPANY
Boston Chicago Detroit Los Angeles
PRODUCERS OF BELLOWS EXCLUSIVELY
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Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 134. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING

No. 2751. AIR CONDITIONING: Carrier Corp., Syracuse, N. Y. 12 p. booklet featuring profits and advantages of air conditioning for small stores and offices, particularly with self-contained units, including brief descriptions of 3 and 5 ton units and showing different room layouts.

No. 2752. AIR CONDITIONING INSTRUMENTS: Moeller Instrument Co., 132nd St. and 89th Ave., Richmond Hill, N. Y. 40 p. catalog (No. 65) on mercury, dial indicating and recording thermometers, and hygrometers for air conditioning, heating and ventilating.

No. 2753. AIR CONDITIONING UNITS: Clarage Fan Co., Porter St., Kalamazoo, Mich. 36 p. bulletin (No. 107, Edition No. 2) on "Multitherm" conditioning units, including tables of heating and cooling capacities, speed and horsepower tables, sample problems, and engineering data.

No. 2754. AIR ELIMINATORS: Gorton Heating Corp., Cranford, N. J. 4 p. bulletin (No. 106) describing high pressure air eliminators for quick and automatic venting of steam coils and mains, unit heaters, and processing equipment.

No. 2755. BELTS: L. H. Gilmer Co., Keystone and Cottman Sts., Tacony, Philadelphia, Pa. 144 p. 1938 catalog on belts, containing many new listings.

No. 2756. BOILER METERS: Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, Ohio. 32 p. bulletin (No. 46) containing an analysis of 7,000 combustion tests on all types and sizes of boilers fired by various methods. In addition to describing boiler meters and how they reduce operating cost, the bulletin shows graphically the average percentage of excess air with which various classifications of boiler units are operating in actual practice.

No. 2757. CAPACITORS: General Electric Co., 1 River Rd., Schenectady, N. Y. 24 p. publication (No. GEA-2742) on "Pyranol" capacitors for low voltage industrial applications.

No. 2758. COOLING TOWERS: Foster Wheeler Corp., 165 Broadway, New York, N. Y. Issue of "Heat Engineering" (Vol. 13, No. 2) including an article on water savings with cooling towers and discussing the installation at the R. H. Macy & Co. department store, New York City. A cost analysis is given.

No. 2759. DEHUMIDIFICATION: Research Corp., Chrysler Bldg., New York, N. Y. 16 p. bulletin on the manufacturer's system of air conditioning featuring chemical dehumidification, with a discussion of the direct method of dehumidification, the equipment and its operation, and showing various layouts. Equipment sizes and weights are tabulated, and data on operating requirements are presented.

No. 2760. DEHUMIDIFIERS: Carrier Corp., Syracuse, N. Y. 8 p. booklet on silica gel dehydrators for providing direct control of humidity independently of temperature. Moisture removal capacities range from 26 to 218 lb per hr.

No. 2761. DUCT INSULATION: Cork Import Corp., 330 W. 42nd St., New York, N. Y. 4 p. bulletin giving information and construction details on square or rectangular air conditioning ducts insulated with "Novoid" corkboard.

No. 2762. EXHAUST FANS: Emerson Electric Mfg. Co., 1847 Washington Ave., St. Louis, Mo. 16 p. catalog (No. X2459) on exhaust fans and ventilators, and accessory equipment, with data on applications, performance, dimensions, etc.

No. 2763. EXPANSION JOINTS: E. B. Badger & Sons Co., 75 Pitts St., Boston, Mass. 16 p. bulletin (No. 100) on corrugated type expansion joints with information on how to select the joint, a sample problem, list prices, dimensions and weights.

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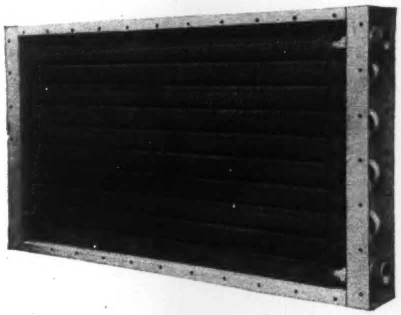

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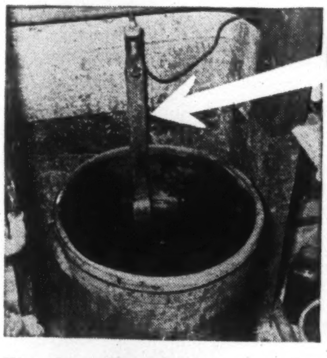

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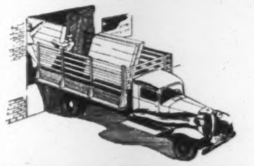

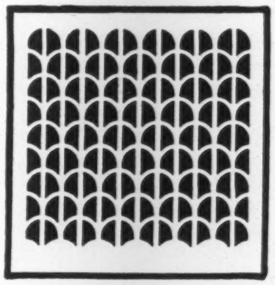

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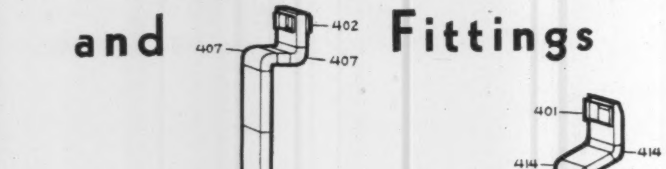

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No. 2764. FLOW METERS: Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., 4534 Wayne Ave., Philadelphia, Pa. Circular (No. 80-36) explaining how flow meters, by metering steam, water, oil and other fluids, can bring to manufacturing processes many of the economies effected in power production. Examples are included.

No. 2765. GAS BURNERS: Lee B. Mettler Co., 406 S. Main St., Los Angeles, Calif. 4 p. bulletin describing "Fan-Air" motorized fan gas burner assembly, its construction and features.

No. 2766. GAS ENGINES: Worthington Pump & Machinery Corp., Harrison, N. J. 8 p. bulletin (No. S-550-B4C) on gas engines, their features and construction, including ratings and dimensions.

No. 2767. GEAR MOTORS: General Electric Co., 1 River Rd., Schenectady, N. Y. 8 p. booklet (No. GEA-1929A) illustrating 21 low speed drives that have been modernized at a saving with gear motors.

No. 2768. GRILLES: Hart & Cooley Mfg. Co., 61 W. Kinzie St., Chicago, Ill. 12 p. booklet on air conditioning grilles with illustrations featuring their distinctive appearance. The booklet was prepared "as an aid to air conditioning contractors in their sales to consumers by helping to create a quality impression for the contractor's proposal."

No. 2769. HOSE: Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J. Instruction card on proper care of rubber hose, giving maintenance rules for unpacking, using and storing. Instructions are included for attaching couplings and for the proper use of steam hose.

No. 2770. HUMIDIFYING: Parks-Cramer Co., 970 Main St., Fitchburg, Mass. Issue of "Parks' Parables" (Vol. 35, No. 3) on "Modernizing Climate in Wamsutta's Weaving," describing the humidifying equipment and its advantages.

No. 2771. INDUSTRIAL SAFETY DEVICES: Willson Products, Inc., Reading, Pa. 34 p. catalog of industrial safety devices, including goggles, welding handshields and helmets, dust respirators, air line respirators, abrasive helmets, etc.

No. 2772. INSTRUMENTS: General Electric Co., 1 River Rd., Schenectady, N. Y. 4 p. bulletin (No. GES-1841) on electrical instruments in industry, describing various examples of how savings were made by their use.

No. 2773. LEAD LINED EQUIPMENT: National Lead Co., 111 Broadway, New York, N. Y. Issue of the "Dutch Boy Quarterly" (Vol. 16, No. 1), including an article on lead lined equipment and lead lined pipe and fittings and their installation.

No. 2774. LUBRICATION: American Chain & Cable Co., Inc., York, Pa. 4 p. folder on pressure lubrication without special fittings, describing the "Acco-Morrow" pressure lubricator.

No. 2775. LUBRICATION: Texas Co., 135 E. 42nd St., New York, N. Y. Issue of "Lubrication" (Vol. 24, No. 3) on "Pumping Operations—Their Relation to Lubrication," with many cross sectional diagrams.

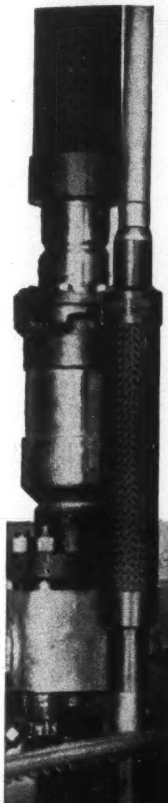
No. 2776. MAGNETIC SWITCHES: General Electric Co., 1 River Rd., Schenectady, N. Y. Leaflet (No. GEA-841H) on magnetic switch full voltage starter for induction motors.

No. 2777. METAL BENDINGS: Wallace Supplies Mfg. Co., 1310 Diversey Pkwy., Chicago, Ill. 8 p. bulletin (No. 29) on metal bendings, and tube and rod bending machines, bar cutters, etc.

No. 2778. METALS: International Nickel Co., Inc., 67 Wall St., New York, N. Y. 16 p. pocket size booklet entitled "6 Minutes with 6 Metals," giving characteristics and information on uses of various types of "Monel," "Inconel," and nickel.

No. 2779. MONEL: International Nickel Co., Inc., 67 Wall St., New York, N. Y. 8 p. bulletin on "Monel" gaskets, pump parts and valve trim, featuring various examples of length of service and "how to put new life into old equipment."

No. 2780. MOTORS: Bodine Electric Co., 2254 W. Ohio St., Chicago, Ill. Issue of "The Motorgram" (Vol. 18, No. 2) including various information on motors and particularly data on the selection and care of motor bearings.



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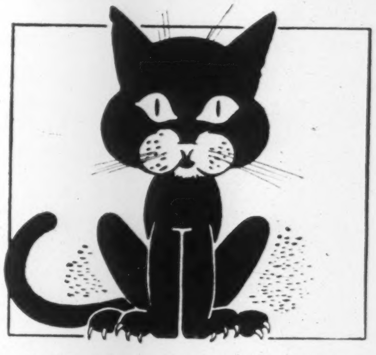

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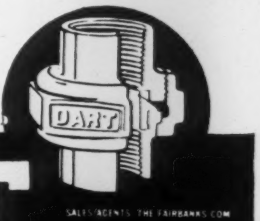

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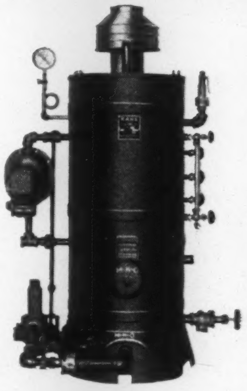

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No. 2781. MOTORS: Crocker-Wheeler Electric Mfg. Co., Ampere, N. J. 8 p. bulletin (No. 251) on alternating current polyspeed motors capable of efficient and stable speed regulation over a wide range in speed. Features and construction are described and operation and speed regulation discussed in detail. Applications are briefly described.

No. 2782. PIPE INSULATION: Cork Import Corp., 330 W. 42nd St., New York, N. Y. 4 p. bulletin on "Novoid" cork covering, comparing refrigeration loss from bare pipe lines and insulated lines. Heat transmissions through various thicknesses are tabulated, and a table of minimum line temperature for specified cover thickness is presented.

No. 2783. PIPE TOOLS: Beaver Pipe Tools, Inc., Keeney Ave., Warren, Ohio. 8 p. bulletin announcing a full range ⅛ to 2 in. pipe and bolt machine which may be purchased complete or in units; also a 4 p. condensed catalog on pipe tools.

No. 2784. POTENTIOMETERS: Bristol Co., Platts Bridge, Waterbury, Conn. Circular featuring the newly developed "Pyromaster" potentiometer with a simplified operating mechanism.

No. 2785. PUMPS: Ingersoll-Rand Co., 11 Broadway, New York, N. Y. 16 p. bulletin (No. 7067) on "Cameron" two stage centrifugal pumps available in capacities from 100 to 2200 gpm for discharge heads up to 800 ft (350 lb per sq in.).

No. 2786. RAILROAD AIR CONDITIONING: American Car & Foundry Co., 30 Church St., New York, N. Y. 8 p. reprint giving technical information on the new air conditioning equipment consisting of 29 cars recently placed in service by the Missouri-Kansas-Texas lines.

No. 2787. REGISTERS: Auer Register Co., 3608 Payne Ave., Cleveland, Ohio. 72 p. register book (No. 38) illustrating and listing registers, intakes and grilles for gravity heating and air conditioning systems. Many recently added models are included.

No. 2788. REMOTE GAS PRESSURE CONTROL: Bristol Co., Platts Bridge, Waterbury, Conn. 4 p. bulletin describing "Metameter" system for telemetering and controlling gas distribution pressure.

No. 2789. REMOTE TRANSMISSION: Brown Instrument Co., Div. of Minneapolis-Honeywell Reg. Co., 4534 Wayne Ave., Philadelphia, Pa. 4 p. folder (No. 94-1) on pneumatic remote transmission system for remote transmission of measurement and control in hazardous atmospheres.

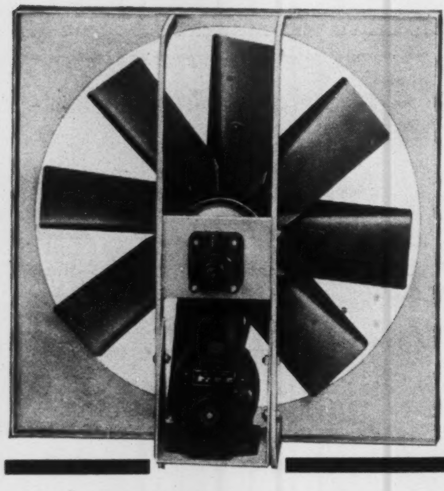
No. 2790. ROOM COOLERS: Pleasantaire Corp., 1623 Connecticut Ave., Washington, D. C. 4 p. bulletin on window type room coolers for rooms of 200 sq ft or less, describing construction in detail and giving specifications.

No. 2791. UNIT COOLERS: Fedders Mfg. Co., Inc., 57 Tonawanda St., Buffalo, N. Y. Issue of "Fedders News" (Vol. 5, No. 3) featuring application of unit coolers.

No. 2792. UNIT HEATERS: Carrier Corp., Syracuse, N. Y. 32 p. bulletin (No. 468A) on "Heat Diffusers" with information on construction and applications, and including dimension drawings, rating tables, engineering examples, piping and control diagrams, specifications, etc.

No. 2793. VALVES: Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn. 16 p. bulletin (No. 5-7000) on redesigned line of forged and cast steel valves, with dimensions, list prices and weights. A table of service ratings is included.

No. 2794. VENTILATION: Air Controls, Inc., 9205 Detroit Ave., Cleveland, Ohio. 26 p. booklet ("Rex Airate Trail") designed to serve as a guide to air circulation in home, store,



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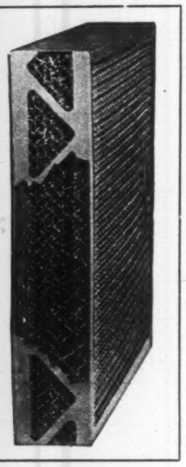

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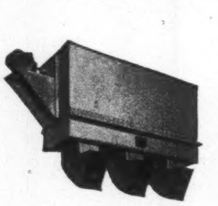

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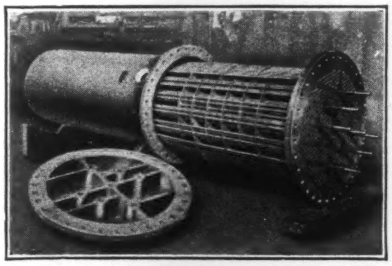

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Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

1454	1455	1456	1457	1458	1459	1460
1461	1462	1463	1464	1465	1466	1467
1468						
2751	2752	2753	2754	2755	2756	2757
2758	2759	2760	2761	2762	2763	2764
2765	2766	2767	2768	2769	2770	2771
2772	2773	2774	2775	2776	2777	2778
2779	2780	2781	2782	2783	2784	2785
2786	2787	2788	2789	2790	2791	2792
2793	2794	2795	2796.			

Name.................................... Title..............
Company ....
Address ....
City.................................... State..............

shop and factory. Advantages of ventilation in industrial, commercial, and residential buildings are described and many examples are given.

No. 2795. VIBRATION CONTROL: Korfund Co., Inc., 48-15 32nd Pl., Long Island City, N. Y. 12 p. technical bulletin on vibration control of internal combustion engines, referring to the need of protection against the transmission of machine vibrations and outlining the laws governing their control. Various isolating materials are discussed with relative advantages and applications in actual use.

No. 2796. WROUGHT IRON: A. M. Byers Co., Clark Bldg., Pittsburgh, Pa. 40 p. bulletin on wrought iron for piping systems discussing pipe materials; cost; pipe selection; why metals resist corrosion; water supply, drainage, heating and power systems; and including a section on installation procedure.

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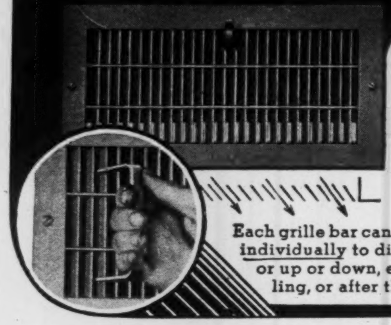

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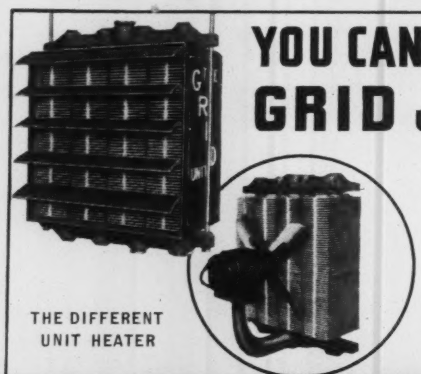


... No electrolysis
... More air changes per hour
... Do away with maintenance
... Long life of unit
Send for complete details.

The Unit Heater & Cooler Co.
Wausau, Wisconsin

THE DIFFERENT UNIT HEATER

GRID UNIT HEATER

Coils Gummy with Bad Smelling Vapors?

Gummed coils reduce Air Conditioning efficiency by a large degree,—cause "Air Conditioning Stench."

Annis Air Filters and Annis Odor-pak Filters remove dust, soot, oil, and smells, including tobacco, cooking, body odors, etc.

ANNIS ENGINEERING

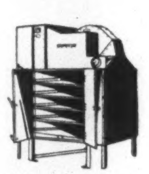
Write for bulletins.

ANNIS AIR FILTERS 1515 GARDENA AVENUE
GLENDALE, CALIFORNIA

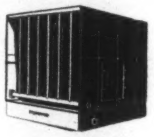
Get Rid of Dust, Fumes, Excess Heat —and save money!

Sturtevant
Sturtevant
REG. U.S. PAT. OFF.
Puts Air to Work

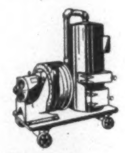
One of the six Sturtevant Rexvane Fans exhausting corrosive fumes in the plant of Halowax Corp., Wyandotte, Mich.



Drying Equipment



Air Washers



Vacuum Cleaners

DUST "on the fly" clogs expensive equipment . . . often creates serious fire risks . . . hampers workers and endangers their health. Fumes and excess heat from processing operations also slow up workers . . . breed carelessness and inaccuracy . . . and are health hazards.

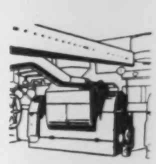
Get rid of these costly handicaps . . . which increase operating costs at a time when economy is so essential!

No matter what your problem may be . . . Sturtevant has the experience and equipment to meet it. Sturtevant Equipment and Complete Systems are available for exhausting dust, fumes and heat . . . for ventilating . . . heating . . . process air conditioning . . . and for many other similar purposes.

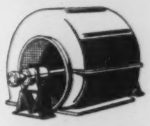
A Sturtevant Engineer in our nearest office would be glad to discuss your problem with you . . . and to make available the advantages of our 75 years of air engineering experience.

B. F. STURTEVANT CO., Hyde Park, BOSTON, MASS.

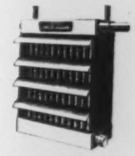
Branch Offices in 40 Other Cities B. F. Sturtevant Co. of Canada, Ltd. — Galt, Toronto, Montreal



Air Conditioning

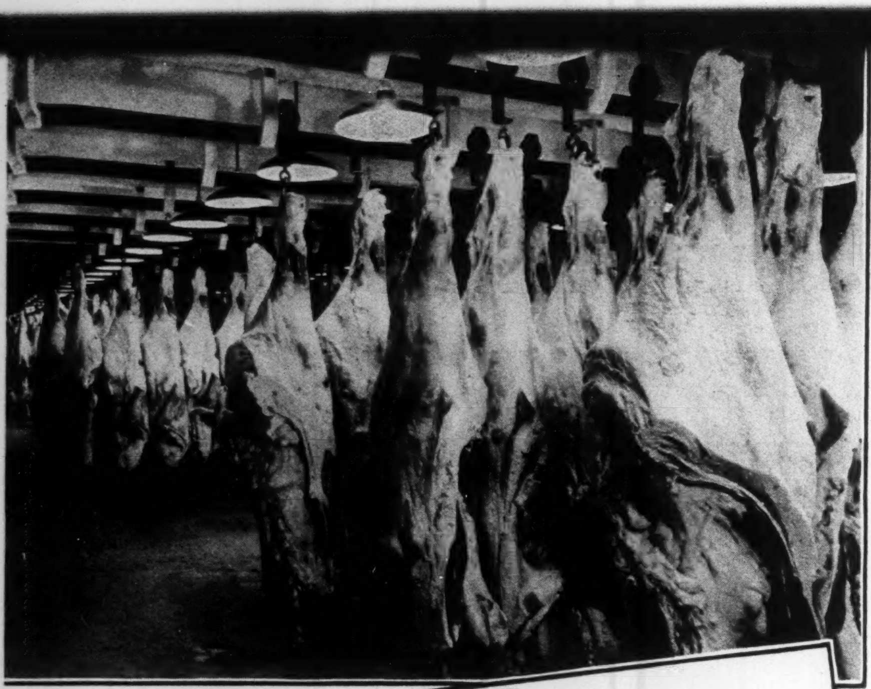


Draft Equipment



Unit Heaters

WORLD'S LARGEST MAKER OF AIR HANDLING AND CONDITIONING EQUIPMENT

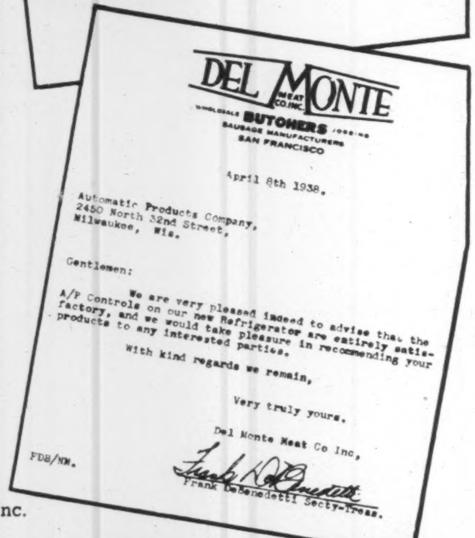


250
BEEVES
at
2° to 36° F.

For human comfort or food preservation — wherever *exacting* refrigeration control is demanded — there is the place for an A-P Thermostatic Expansion Valve.

Refrigeration Engineers are invited to see an A-P Thermostatic Expansion Valve or Solenoid in use — anywhere,— on any size installation. Judge all A-P Valve Service on the satisfaction of any *ONE,* if you wish. It's complete Dependability on every installation, without exceptions, that has built the A-P reputation.

Next time, use an A-P Valve if you would enjoy freedom from valve-trouble — and your customer's satisfaction.



DEL MONTE MEAT CO. INC.
WHOLESALE BUTCHERS JOBBING
SAUSAGE MANUFACTURERS
SAN FRANCISCO

April 8th 1938.

Automatic Products Company,
2450 North 32nd Street,
Milwaukee, Wis.

Gentlemen:

We are very pleased indeed to advise that the A/P Controls on our new Refrigerator are entirely satisfactory, and we would take pleasure in recommending your products to any interested parties.

With kind regards we remain,

Very truly yours.

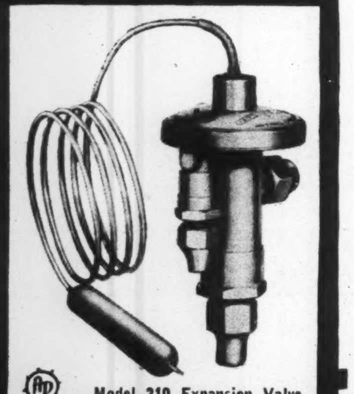
Del Monte Meat Co Inc,

Frank DeBenedetti
Frank DeBenedetti Secty-Treas.

FDB/NM.

- *Installation . . .*
  - Del Monte Meat Co., Inc.
  - San Francisco, Calif.
  - Storing 250 Beeves at One Time.
- *Refrigeration Unit . . .*
  - Mills Company
- *Installed by . . .*
  - Oris Olsen Refrigerator Co.
  - San Francisco, Calif.
- *Valves . . .*
  - 6 No. 210 Thermostatic Expansion Valves
- *Purchased through . . .*
  - California Refrigerator Co.
  - San Francisco, Calif.

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE WISCONSIN
rt Department, 100 Varick Street, New York City



Model 210 Expansion Valve

EPENDABLE
THE BYWORD FOR A-P VALVES

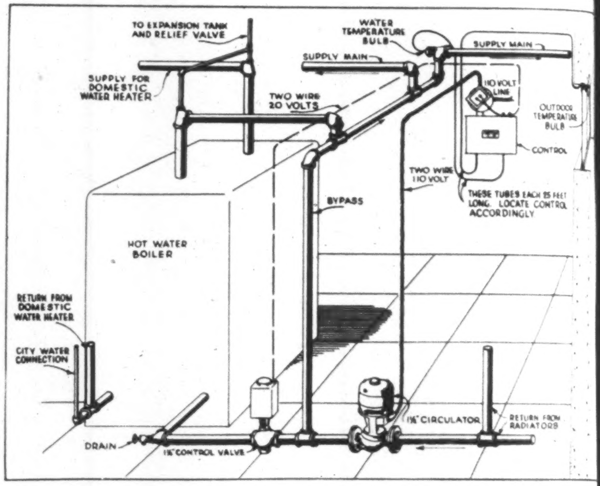
Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 128.

Announces Hot Water Heating Equipment

No. 1469*—New hot water controlled heat system, annou last month by a company who has for 25 years been mak steam heating specialties, is based on continuous circulation the heating medium. The "brain" of the new system is a paten temperature controller, and temperature control is based o balanced condition between outdoor and radiator temperatu Anticipating weather changes, the controller is designed to au matically hold water circulated through the pipes and radia to the temperature required to exactly offset the heat loss o building at any given outdoor temperature.

Referring to the diagram, the three major units of the sys are the circulating pump, the control valve, and the tempera controller with outdoor and water temperature bulbs. An exp



sion tank and relief valve are, of course, installed as with oth forced circulation systems. In operation, the boiler is maintain at a constant temperature and the pump runs continuous except when the outdoor temperature rises to about 65 F.

The piping differs from the conventional layout in that bypass and a control valve are installed *between* the pump an the boiler and unless the control valve is open, the water cir lating through the piping and radiators does not pass throu the boiler. When the water in the circulating system dr below the required temperature to offset the heat loss of t building, the water bulb, through the temperature controll causes the control valve to open, admitting hot water from th boiler into the circulating system. Should the outdoor temper ture drop, the outdoor bulb causes the control valve to open an admit hot water from the boiler into the system to maintain proper temperature in the radiators.

Thus, during periods of approximately constant outdoor te perature, operation of the system is dependent upon the wa temperature bulb. When outdoor temperature drops, the outdo bulb and temperature controller cause the control valve to op to maintain the proper balance.—Hoffman Specialty Co., In Waterbury Natl. Bank Bldg., Waterbury, Conn.

Wrench Indicates Torque

No. 1470—The proper installation of pipe flanges, couplin cylinder heads on multi-cylinder gasoline and diesel mot pump and turbine casings, etc., requires that bolts be drawn evenly in order to avoid possibility of leaks.

HEAR'EM
ABSO-DRY PRESSURE SEALED
DEHYDRATOR
ABSO-DRY PRESSURE SEALED DRYER
YOU'VE BOUGHT A GOOD PRODUCT YOU'LL REMEMBER WHERE YOU GOT IT
PROCESS PATENTS
(Applied For)

HISS-S-S!

INTRODUCING the NEW—
ABSO-DRY Pressure Sealed Dryers

ABSO-DRY GUARANTEE

Every trace of moisture has been removed from this dryer by the exclusive Henry Vacuum Process. When the seal cap at the inlet end is removed, there is a hissing sound due to the escape of dehydrated air. This is your guarantee that the dryer has reached you in the same condition as when it left the factory and that original drying efficiency has not been impaired. *If this dryer does not hiss, your jobber is authorized to exchange it for a new one.*

Abso-Dry DRYERS
STRAINERS
and VALVES
HENRY
REFRIGERATION AND AIR CONDITIONING
CATALOG NO. 73

YOURS
FOR
THE
ASKING

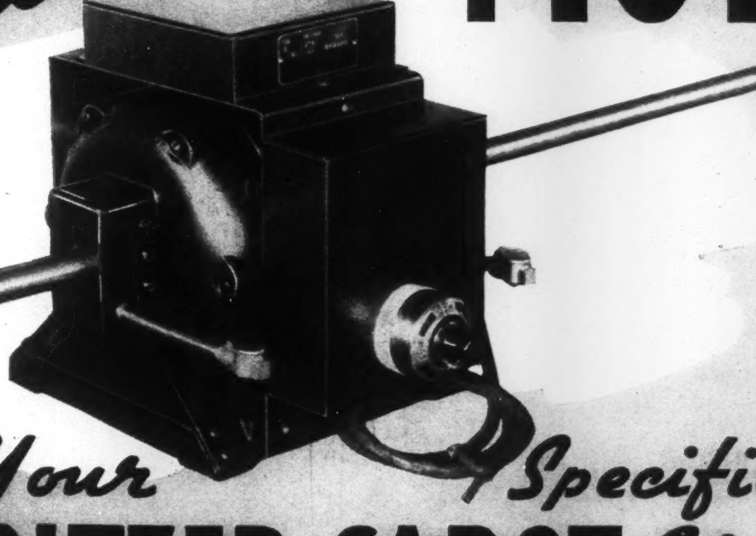
Every trace of moisture is removed from these new Abso-Dry Units by the exclusive Henry Vacuum Process. When the seal cap at one end of the dryer is removed, there is a hissing sound, due to the escape of dehydrated air. This is audible proof that no moisture has been absorbed up to time of actual installation.

Best of all, the Abso-Dry Pressure Sealed Dryers offer you at no increase in price, all the other features of engineering design and construction that have been responsible for Henry's rise to Leadership in the industry.

Stocked by Leading Jobbers

HENRY VALVE CO.
1001-19 North Spaulding Avenue, Chicago
Complete Line of Ammonia Valves and Forged Steel Fittings

Custom Built MOTORS



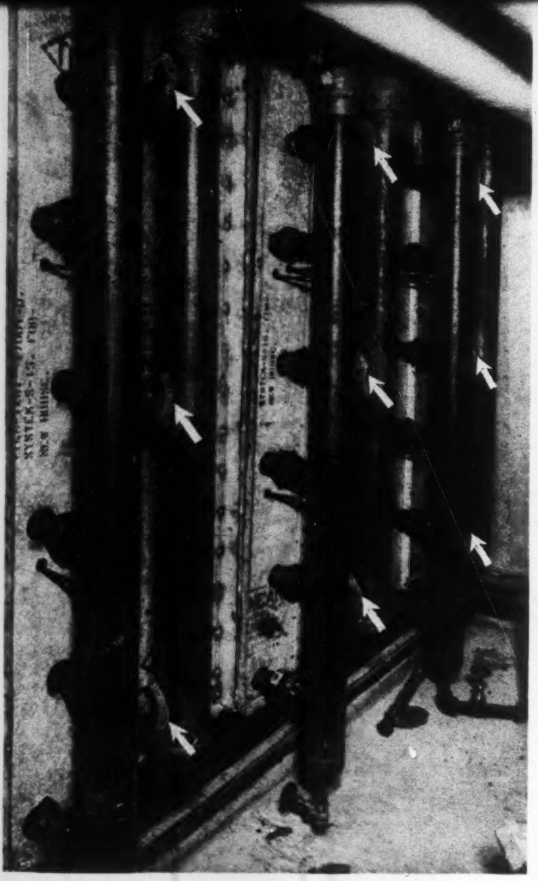
For Your Specific Needs

The HOLTZER-CABOT Electric Co.
CHICAGO-NEW YORK BOSTON MASS. PHILADELPHIA

...arks registered in the United States Patent Office. Full
...atent coverage for designs, principles and construction has
...een granted in the United States and foreign countries.

For
ir Conditioning

BONNEY
VELDOLETS
HREDOLETS



WHEN welded piping was specified for the air conditioning system at the New House of Representatives Office Building, Washington, D. C.—the largest air conditioning contract ever awarded—Bonney WeldOlets and ThredOlets were specified or making branch pipe connections.

Engineers and contractors recognize the fact that they are orrectly designed, make stronger outlets than any other method of making take-offs and are economical to buy and install.

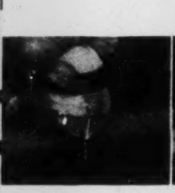
WeldOlets and ThredOlets eliminate all cutting, threading nd fitting of the main pipe. They make branch pipe connections of full pipe strength that are absolutely leak-proof. Their funnel-haped outlets improve free flow conditions and reduce turbulence nd friction to a minimum.

Your piping job may not be air-conditioning, but regardless of what it is for—whether new construction or maintenance—WeldOlets and ThredOlets will make better take-offs at less cost than any other fittings.

Standard fittings are drop-forged of steel, but they're available in Toncan Iron, Wrought Iron, Brass, Monel, Everdur, etc. o meet every piping need.

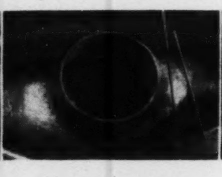
Improve your next piping job and save with these fittings. Once used, you'll standardize on them. For full information write for Bulletin WT23 or see your nearest distributor.

They are easily installed!

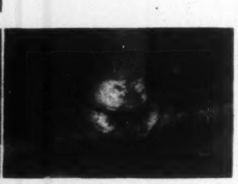


Weldolets and redolets are ickly and easily talled. Select the sition of the outlet ywhere on the in pipe, mark cen- lines and tack the ing into position.

Then weld by electric-arc or oxy-acetylene method. A leak-proof joint of full pipe strength is obtained.



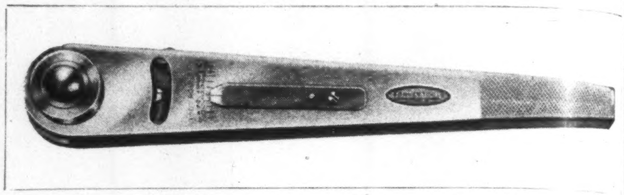
On 2" outlets or larger, the button is removed after installation. A full inspection of the inside of the joint is possible when WeldOlets and ThredOlets are used.



A simple Vee weld is used for attaching the branch when WeldOlets are used. If ThredOlets are used, the branch is screwed into position.

ONNEY FORGE & TOOL WORKS-Allentown, Pa.
WELDOLETS · THREDOLETS
. . . *Welded Outlets for Piping* . . .
Stocked by Leading Distributors

A new torque indicating wrench for measuring the tension of each bolt so that all of them will be even is now available. Features include a ratchet mechanism that is reversible, and n dials or gages to get out of order or that may be damaged by

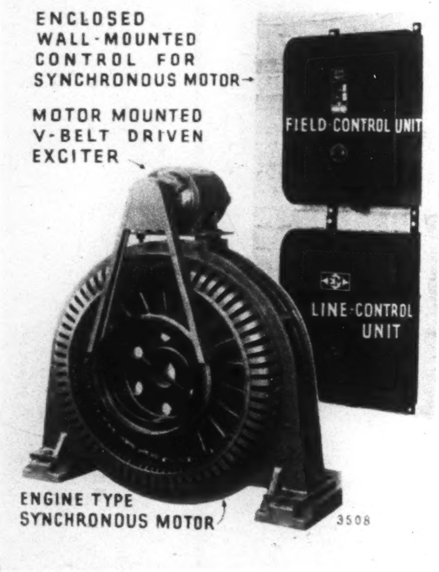


careless handling. The handle does not swing free when the desired torque is reached because the ratchet mechanism locks, thus preventing smashed fingers for the user.

The indicator is set at the desired torque in foot pounds. This is done by loosening an indicator clamping screw, moving the indicator to the desired position on the scale and then tightening the screw. The ratchet lever is moved to the extreme left of the wrench. The wrench is operated just as any ratchet wrench until the ratchet lever snaps to the neutral position in center. A sharp "click" is heard and the ratchet locks as a further indication that the desired torque has been reached.—Bonney Forge & Tool Works, Tilghman & Meadow Sts., Allentown, Pa.

Synchronous Motor for Small Compressors

No. 1471—To make direct connected synchronous motors more practical and advantageous for smaller industrial reciprocating compressors requiring down to 40 hp, a new type of equipment is offered, has advantages of lower first cost, simpler installation, and smaller floor space requirement than previously attainable with synchronous motor drive for air and gas compressors, and for refrigeration compressors used for air conditioning and other cooling purposes.


ENCLOSED WALL-MOUNTED CONTROL FOR SYNCHRONOUS MOTOR
MOTOR MOUNTED V-BELT DRIVEN EXCITER
FIELD CONTROL UNIT
LINE-CONTROL UNIT
ENGINE TYPE SYNCHRONOUS MOTOR
3508

Features are (1) exciter mounted on top of the synchronous motor, V-belt driven from a sheave on the rotor of the motor, and (2) automatic, enclosed wall mounted control which is supplied instead of a panel mounted starter.

The motor mounted exciter eliminates the floor space and extra wiring necessary where a separate induction motor generator set is used for excitation, the maker states. The wall mounted enclosed control requires relatively small space, is simple to install, and is low in first cost.—Electric Machinery Mfg. Co., 1331 Tyler St., N. E., Minneapolis, Minn.

Air Cleaner for Grinding, Welding

No. 1472*—A new machine which filters dirt particles from air and which is said to remove approximately 95 per cent of the dirt from the air in the vicinity of grinding, welding and other shop operations, was announced last month. It also draws smoke and heat away from the work.

1 2 3 4 5 **6** 7 8 9 10 11 12 13 14 15

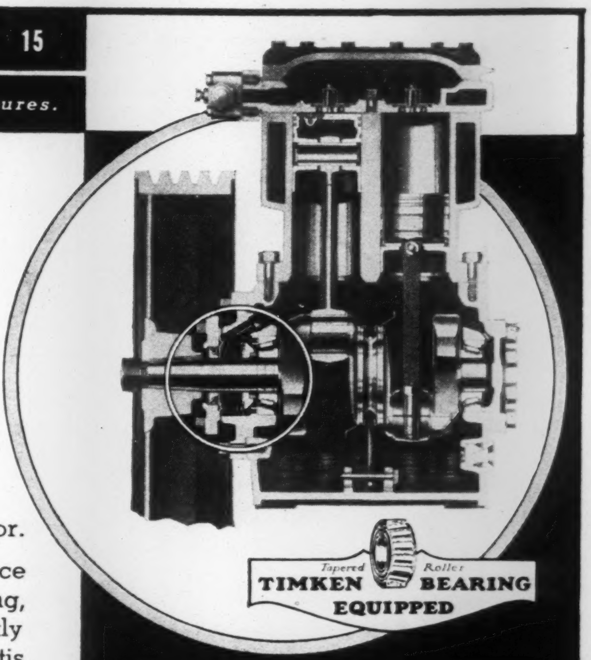
No. 6 of a Series of Curtis Advanced Engineering Features.

CURTIS Balanced Bellows Seal Insures Even Pressure, Long Life, Easy Accessibility and Renewal

● The Curtis balanced bellows seal, using a multiplicity of calibrated springs insures uniform pressure on the entire sealing surface. Regardless of crankcase pressure the seal assembly is perfectly balanced at all times. The seal surface is on the wide inner race of a special Timken Bearing and the extremely hard Timken steel assures unusually long seal life. Furthermore, the bearing can be replaced and lapped without dismantling the entire compressor.

This is another example typical of Curtis' experience and precision engineering, resulting in outstanding, efficient, economical performance—a fact constantly proven in thousands of installations. There is a Curtis model for every refrigeration and air conditioning requirement, from 1/6 to 30 H.P.

Write to Curtis for details of the complete Curtis line.



CURTIS

"Builders of Condensing Units Since 1922"

CURTIS REFRIGERATING MACHINE CO.
Division of Curtis Manufacturing Co.
1950 KIENLEN AVENUE, ST. LOUIS, MO.

Ask the AEROFIN Man

To Help You on Your Cooling or Heating Problems

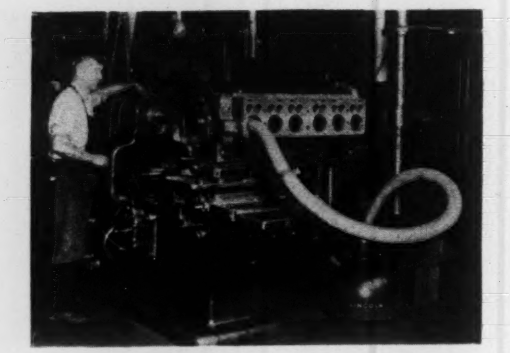
Aerofin Corporation, through its home office and six strategically located branch offices, is prepared to help you on all problems involving the application of Aerofin heat exchange surface or to suggest the most efficient use of this superior surface to a variety of requirements.

The prompt, personal and technical cooperation of our engineers is at your disposal. Write to the home office in Syracuse or consult your local telephone directory for addresses of branch offices listed.

AEROFIN

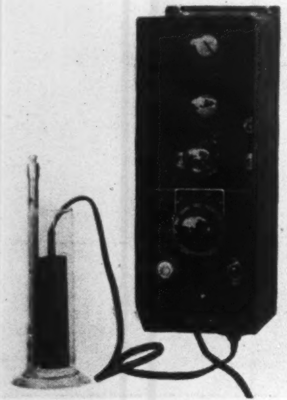
Heat-Exchange Surface

AEROFIN CORPORATION
410 SOUTH GEDDES STREET, SYRACUSE, N. Y.
Chicago • Detroit • New York • Philadelphia • Dallas • Atlanta



Known as the "Linconditioner," it consists of a motor driven fan which produces suction through a flexible metal tube. The fan draws the air through the flexible tube and exhausts it in a filter which is located in the periphery of the power unit. The flexible tube is supported by a welded steel arm and spring arrangement, so that the nozzle can be shifted to any desired spot within the operating radius of the tubing.—Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

Instrument Indicates Dissolved Solids

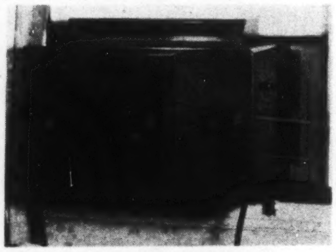


No. 1473—Illustrated is the recently developed "Nalco Blinker" which acts as a continuous indicator of the correct solids content in condensate, steam, feed or boiler water and may be used for checking the quantity of dissolved solids in any water containing from 1 ppm to 700 grains per gallon. Most popular use of the device is to check continuously the solids in the main steam header of a plant to insure pure steam at all times. This is done by taking a continuous sample of steam through a cooling coil and passing the condensed steam through an electrode connected by wires to the instrument which may be in any convenient location—engineer's office, laboratory, boiler room, etc. Any water—such as blow down, feed water, or condensate—may be checked in the same manner.

The instrument measures conductivity, which is affected by temperature and difference in type of solids. The temperature is automatically taken care of by a fixed scale behind the rotating dial on the instrument and no calculating is necessary since solids are read direct. It may be used for checking leaks in heating or cooling coils, to tell when a zeolite softener is sufficiently backwashed, or to check mineral solids in the low percentages in any water.—National Aluminate Corp., 6621 W. 66th Pl., Chicago, Ill.

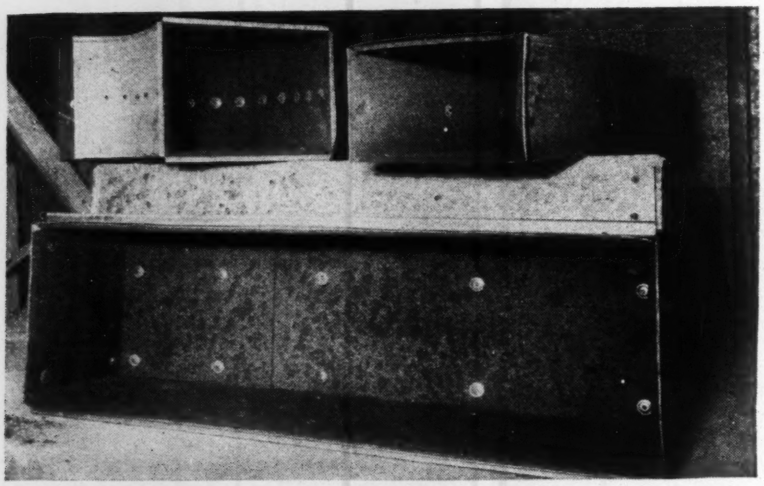
Window Type Cooling Units Announced

No. 1474—Illustrated is an air cooled portable window unit recommended by the manufacturer for spaces up to 2500 cu ft with ordinary exposures such as hotel, hospital, office and residential rooms. A smaller unit is available for spaces of 1500 cu ft.



According to the maker, the larger type has a cooling capacity of 6000 Btu per hr, an air delivery of 275 cfm, and will provide up to 75 cfm of outside air. Filters are of oil treated glass fiber. Dimensions are 28 in. deep, 25 in. wide, and 16 in. high, and weight is 280 lb.

Standard current is 110 volts a-c, 60 cycles. Units for other a-c and d-c currents of various voltages and



LINING DUCTS for Sound Absorption?

...Make sure you get FIRE and MOISTURE RESISTANCE, too!

REPORTS of fires taking hold on combustible duct linings and causing serious damage come as a warning from the National Board of Fire Underwriters!*

With life and property in danger, the use of a material that provides fire-safety, as well as sound absorption, becomes a necessity.

J-M Air Acoustic Sheets perform exactly that function. This sound-absorption material cannot burn or smolder . . . will never contribute to fire spread. And being moisture resistant, Air Acoustic Sheets are exceptionally free from the dangers of humidity.

Furthermore—their high rate of sound absorption (up to 80%) . . . light weight, assuring easy handling and application . . . the permanence of their mineral composition . . . their high transverse strength and low thermal conductivity . . . all make this material outstanding in its field. For complete data on J-M Air Acoustic Sheets, write Johns-Manville, 22 E. 40th Street, New York City.

JM Johns-Manville

AIR ACOUSTIC SHEETS *FOR DUCT LINING*

*A recent bulletin from the N.B.F.U. reports several cases in which combustible duct linings caught fire and contributed to greatly increased loss.

BAKER SCORES AGAIN!
UNION PACIFIC STAGES

World's FIRST Fleet of Air Conditioned Buses Equipped with BAKER Units

★ Air conditioning is going places this year — by Interstate and Union Pacific bus! And BAKER adds another FIRST to its long list of pioneering achievements in the air conditioning field, for the heart of this new bus air conditioning system is the BAKER automatic unit developed and perfected especially for this purpose.

Thus BAKER demonstrates again its ability to design and manufacture equipment to meet the specific requirements involved, no matter how different or unusual. You, too, can benefit by BAKER'S more than 30 years' experience in the development and manufacture of mechanical cooling equipment. For complete information, write the factory.

BAKER ICE MACHINE CO., Inc.
1508 EVANS ST. OMAHA, NEBR.
Branch Factories: Fort Worth, Los Angeles, Seattle. Eastern Sales: New York City. Central Sales: Chicago. Sales and Service in All Principal Cities.

Authority on Mechanical Cooling for Over 30 Years

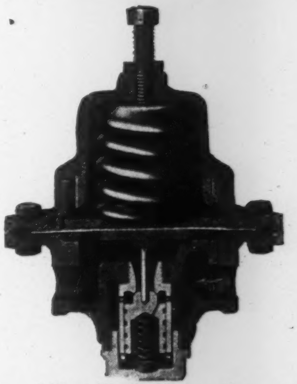
PRESSURE REGULATORS FOR EVERY PURPOSE

DAVIS
CONTROL PRESSURE

No. 15—This is a balanced, counterweighted diaphragm type regulator especially designed to give sensitive low pressure regulation on vapor heating systems. Unaffected by supply pressure variations. Packing boxes are eliminated; hence no leakage, no stem friction.

THE Davis line of automatic pressure reducing valves is complete—there is a type and size available to fit any job whether it be on steam, air, gas, water, or oil. The line includes a full range of regulators suitable for dead-end service as well as continuous flow. Davis recommendations are not biased by any favored types. As the job dictates, you are free to choose between direct or pilot control . . . spring or weight loading . . . piston or diaphragm action. Standard sizes range from ⅜ in. to 24 in. for pressures up to 1500 lbs. Larger sizes available on special order. You have your choice of the degree of sensitivity needed for the job—you don't have to pay for more than you need.

CHOOSING the right style is made easy by the Davis Regulator Service Chart. Specifications and ratings according to service. *Write for a copy or see it at your jobber's.* DAVIS REGULATOR CO., 2546 S. Washtenaw Ave., Chicago, Ill.

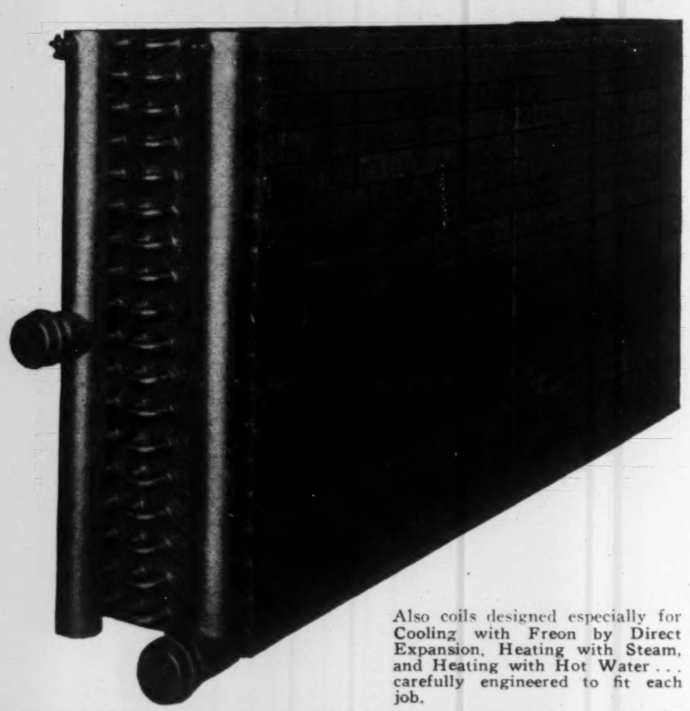


No. 13—Truly the modern regulator for unit heaters, water heaters, laundry ironers, sterilizers, vulcanizers, etc. Spring cap removable by hand—Built-in strainer—All parts accessible without breaking pipe connections—Tight closing—For steam, air, or gas service.

DAVIS REGULATOR CO.

PRESSURE REGULATORS • STOP AND CHECK VALVES • LIQUID LEVEL CONTROLLERS • BACK PRESSURE VALVES
STRAINERS • PUMP GOVERNORS • BUTTERFLY VALVES • FLOAT VALVES • RELIEF VALVES • SOLENOID VALVES
MOTOR OPERATED VALVES • NON-RETURN VALVES

BUSH
AIR CONDITIONING
COILS



Also coils designed especially for Cooling with Freon by Direct Expansion, Heating with Steam, and Heating with Hot Water . . . carefully engineered to fit each job.

COIL DESIGNED FOR COOLING WITH WELL WATER

This Coil is made in one section having a total exposed surface of 2204 square feet.
The face is 64" wide and 38⅛" high. The depth is 12⅝".
It is 18 rows high and 6 rows deep.
The Tube is ⅝" O. D. tinned copper expanded into 2" square Aluminum Fins spaced 6 per inch.
It was designed for the following conditions:
C.F.M. 8,470
F.P.M. 500
Entering Air 85° D.B. 70° W.B.
Leaving Air 66° D.B. 61.7° W.B.
Well Water at 52° and 45 gallons per minute.
Calculated Load 225,000 B.T.U.'s per hour.
As was the case on past installations this Coil was built to fit a specific job. If your requirements call for more or less Surface, larger or smaller Tube, larger Fins, or wider Fin Spacing, it is still standard with Bush and we can take care of your needs.

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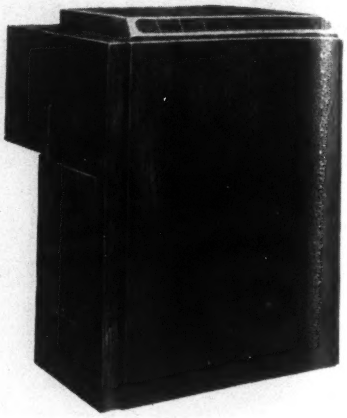
100 VARICK ST.
NEW YORK CITY
TEL.—WA. 5-0345
CABLES—ARLAB

HARTFORD, CONN.

BRANCH FACTORY 610 N. OAKLEY BLVD. CHICAGO, ILL.

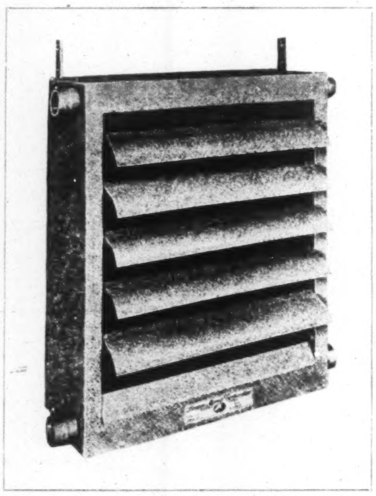
cycles are available at small extra cost.



The same manufacturer has also recently introduced a portable room cooler recommended for 4000 cu ft and supplying 350 cfm of air. Cooling capacity is 10,000 Btu per hr and the power requirement is 1 hp.—Kauffman Air Conditioning Corp., 4485 Olive St., St. Louis, Mo.

Heaters in 14 Sizes Available

No. 1475—The unit heater illustrated is one available in 14 sizes with capacities ranging from 20,850 to 318,000 Btu per hr. They may be used with steam pressure up to 250 lb.



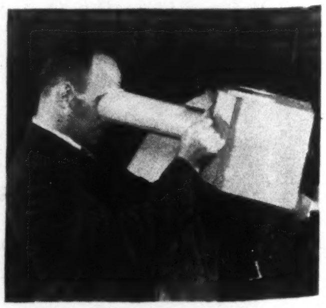
The entire heating element is of copper to give high heat transfer and prevent corrosion, and the copper fins are straight to prevent accumulation of dust. The fins are bonded to the tubes by hydraulic pressure.

Even distribution of the steam over the entire radiator is accomplished by orificing the inlet ends of the tubes. According to the manufacturer, temperature strains are thus reduced to a minimum by keeping an even distribution of steam over the entire face.

Cabinets are of heavy gage welded steel and have provisions for extending the male steam connections out on both the right and left hand side of the unit. Return connections are also piped from either side for simple installation. Each heater is equipped with a set of curved adjustable louvers.—Beacon-Morris Corp., 702 Beacon St., Boston, Mass.

Instrument Estimates Concentration of Dust

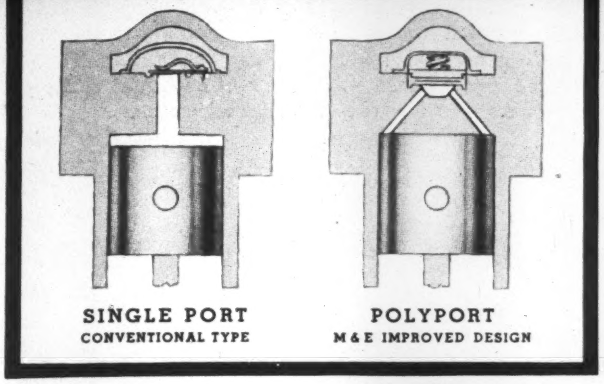
No. 1476**—The new "Dustoscope" is offered as a practical and inexpensive instrument for quickly estimating concentration of dust; it was developed in the chemical engineering laboratories of the Travelers Insurance Co. after several years' experimentation. It permits direct examination of a continuous sample of air, and particles as small as 0.5 micron are visible.



No special technique is required and no microscope and laboratory apparatus is necessary. Weight is 8 lb and the instrument comes complete with a carrying case and 50 ft of cord to give a 100 ft working range.—Service to Industry, Box 133, West Hartford, Conn.

POLYPORT SUCTION AND DISCHARGE **VALVES**

EXCLUSIVE M&E MONEY SAVING FEATURE



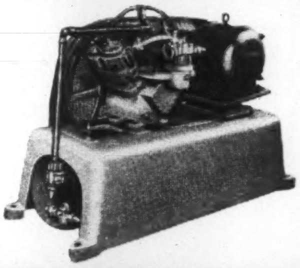
SINGLE PORT
CONVENTIONAL TYPE

POLYPORT
M & E IMPROVED DESIGN

Polyport design is an exclusive M & E feature, providing multiple ports, two or more as may be necessary, for the quick and unobstructed passage of refrigerant through suction and discharge valves. This construction increases volumetric efficiency of the compressor by increasing the amount of the charge. It allows the piston to go right up to the discharge valve plate, silently and without power loss . . . enables the piston to push practically all the compressed gas through the discharge valve and into the system . . . provides maximum refrigeration per kilowatt of power . . . increases efficiency, lowers maintenance costs, reduces noise and vibration, saves money in various ways and in substantial amounts.

Let us tell you more about Polyport design and other features developed by M & E . . . features that make these efficient, economical, long-lived units ideal equipment for every refrigeration and air conditioning need. *Ask for new catalog describing 62 models, ¼ H.P. to 25 H.P.*

MERCHANT & EVANS COMPANY
Philadelphia, Pa., U. S. A. • *Plant at Lancaster, Pa.*



A-20,000-WF (4 cylinder) 10 H.P., heavy duty, for air conditioning theatres, dress shops, and for other purposes requiring maximum capacity

M&E
EST. 1866

M&E CONDENSING UNITS *for the plus values in electric refrigeration*

HUSSEY

Copper Headquarters

OF THE AIR CONDITIONING INDUSTRY!

The exacting service demands of modern air conditioning systems make copper of extraordinary quality imperative. Hussey Copper is just that kind—Pure Lake Copper, if you please, recognized as the most enduring copper obtainable . . . super-armored against corrosion in nature's own crucible—verily the cream of nature's copper crop.

That is why Hussey, with its nationwide network of Eleven Sales Offices and Seven Warehouses has become Copper Headquarters for the quality-minded throughout the air conditioning industry.

C. G. HUSSEY & COMPANY... DIVISION OF COPPER RANGE CO.
General Offices and Rolling Mills: PITTSBURGH, PA.

Would you like a copy of the latest Hussey Catalog?

Copper **HUSSEY** *Brass*

TALLMADGE
Zoned Controlled
HEATING

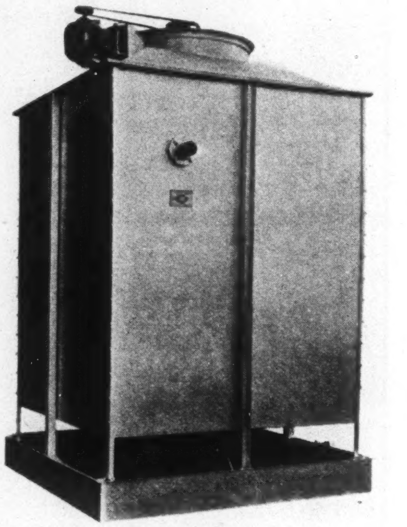
The EQUATHERM, which is a thermostat for automatically modulating the steam to hold an even temperature for the requirements of the room (as it is so sensitive it anticipates the demand), is an important part of Tallmadge Zoned Heating.

BETTER HEATING AT LESS COST
GIVES GREATER COMFORT
Improves Air Conditioning

WEBSTER TALLMADGE & CO.
NEW YORK CITY

Small Induced Draft Cooling Towers Announced

No. 1477—A complete series of small steel-cased induced draft cooling towers have been added to the maker's line of water cooling equipment. They include horizontal wood filled types for use indoors and vertical types for outdoor service, either wood or spray filled. All models, indoor and outdoor, are entirely self contained, with no protrusions or obstructions to present a cleaning problem. They are designed to bring to the small capacity field a maximum of cooling efficiency plus important economies in operation and maintenance.



The indoor towers are horizontal in construction and in air movement. Four standard sizes range from 2½′ x 7½′ x 3′ 2½″ to 2½′ x 8½′ x 6′ 8½″. Casings and basins are 16 ga copper bearing steel, shop painted two coats. They are equipped with fans with guard grilles which may be removed when a discharge duct is used. Zig-zag drift eliminators of heart redwood and cast iron spacers are built as one unit, easily lifted out for access to tower interior. Removable redwood decks and spacers constitute the filler through which the water filters down after down-spray injection at the top. These towers are shipped fully assembled, with simple instructions, ready for operation.

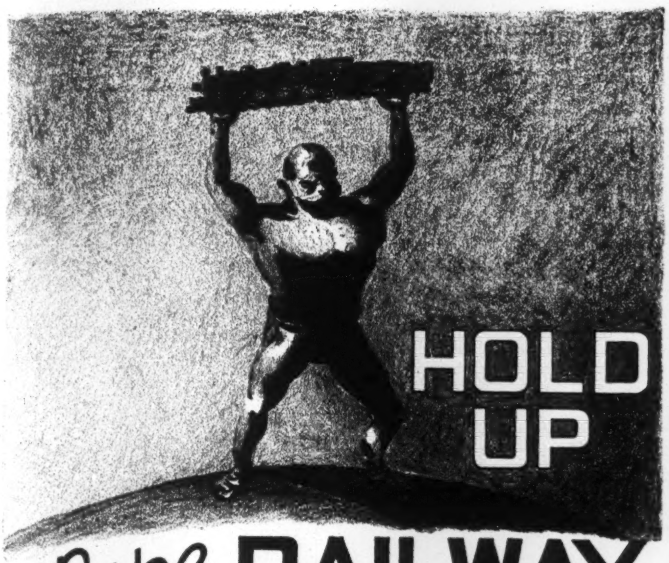
The vertical outdoor towers are available in either wood fill or spray fill types, each in 12 standard sizes from 2½′ x 2½′ x 9′ 1″ to 10′ x 10′ x 14′ 3″. They are equipped with multiple-effect drift eliminators of heart redwood with cast iron spacers and fans having V belt drives from motors mounted on the tower "roofs." In the wood fill type water is up-sprayed at the top and decking is of heart redwood. Two levels of down-spray nozzles are provided in the spray fill types. Both types are shipped knocked down in shop fabricated, easily handled units, which need only to be bolted together for immediate operation.—Marley Co., 3001 Fairfax Rd., Kansas City, Kans.

New Chemical Makes Water Wetter

No. 1478—Practically every operation in which water or water solutions are employed can be benefited by the use of new wetting, penetrating and surface-active agents which are commercially available under the name of "Tergitol" penetrants. Their development is a result of investigations in the field of synthetic organic chemistry whereby previously unobtainable aliphatic alcohol sulphates of high molecular weight have been made available.

A small quantity of the new chemical added to water actually makes the water "wetter"—that is, the water wets whatever it touches almost instantly. Many applications are therefore presented in the process industries where operations involve the use of aqueous solutions.

These penetrants should have application in air conditioning as well. For instance, the "Tergitol' penetrant 7 should be satisfactory for recycling spray type equipment used in air conditioning where water sprays are used to remove dust from the air; and as an aid in the removal of fine particles from industrial gases during scrubbing and similar operations. A concentration of approximately 0.1 per cent of this penetrant should give efficient wetting due to the lowering of the surface tension. The



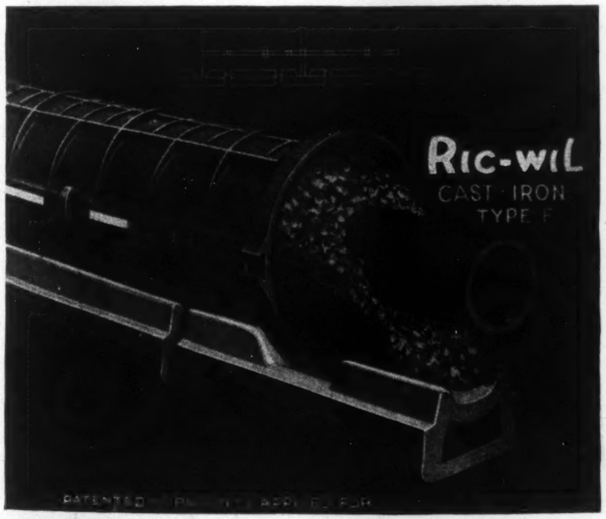
HOLD UP on the RAILWAY

THE "Atlas" of underground conduits for steam lines is a Ric-wiL Cast Iron System. Husky cast iron sections, with ribbed reinforcing, interlocked with Loc-liP Joints for strength and rigidity, can be laid under *train* traffic with assurance of well-engineered stability. Ric-wiL of Cast Iron meets exacting *railway* specifications as to load carrying capacity. Can be used with heavy tile drain or cast iron drain, if required. For traffic conditions of less severity than under railroads—specify a Ric-wiL "SuperTile" system.

Prevent leakage and loss in your steam lines, keep them tight, dry and 90% + efficient with a Ric-wiL Tile or Cast Iron System, insulated with genuine Dry-paC Waterproof Asbestos. Ric-wiL service is complete from design to installation and tests, and is nation-wide. On any subsoil steam conveyance problem—under-supply, fuel waste, loss in transit—Ric-wiL can give you effective assistance. Write for complete catalog and test data.

The Ric-wiL Co., Union Trust Bldg., Cleveland, Ohio
New York San Francisco Chicago
Agents in principal cities

Dry-paC is pure, unadulterated long fibre asbestos, needing no binder. Absolutely open to inspection during installation.



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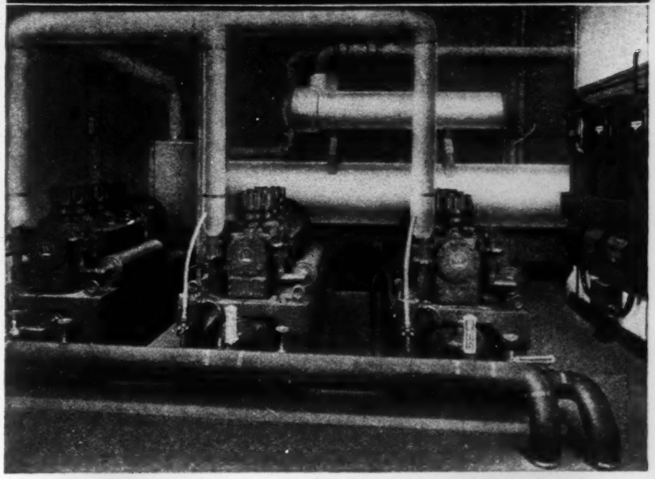
· RIC-WIL ·

CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

Summer Cooling and Winter Heating from ONE System!



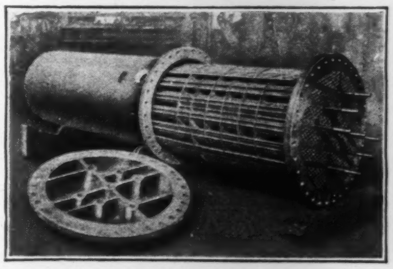
Patterson Converter mounted on Patterson three-circuit Cooler at Kansas Gas & Elec. Co., Wichita, Kan. It provides for Winter heating and Summer cooling with the same coils, fans and duct system.

CHILLED water is supplied to the air-conditioning coils in summer by water circulated through the Patterson Freon Water Cooler. And HOT water is circulated through the same air conditioning coils in winter by heating the water with steam in a Patterson Converter.

Patterson Freon Water Coolers will always deliver superheated gas to the suction line. Proper operation of the thermo expansion valve is thus assured.

The U-tube construction provides for the individual expansion and contraction of each tube and prevents leaks. The entire tube bundle is easily removable for cleaning.

Patterson Coolers are designed for as many circuits as there are compressors and there is a half-century-old organization back of them.



Write for catalog.

The Patterson-Kelley Co., Inc.
107 Warren St. East Stroudsburg, Pa.

Patterson Freon Water Coolers

HEARN STORE CUTS STEAM CONSUMPTION BY MODERNIZATION

Webster Moderator System Gives N. Y. Department Store Better Heating for Less Money

ALL SECTIONS HEATED EVENLY

Modernized Installation Paying for Itself Out of Savings, Store Manager Reports

AN "EXCELLENT INVESTMENT"

New York, N. Y.—Hearn Department Stores, Inc., reduced steam consumption and improved heating service by installing a Webster Moderator System of Steam Heating early in 1936.

Arthur B. Begam, Store Manager, reporting on the operation of the modernized system, said:

"For more than 15 years the Hearn Store was heated by exhaust steam from generator engines. In 1935, the company changed to purchased steam. One month's experience showed that the cost of heating with purchased steam was excessive due to uncontrolled steam piping.

Hearn Department Store, 14th St. at 5th Avenue
New York, N. Y.

"On the recommendation of Stewart A. Jellett Company, well-known Philadelphia consulting engineers, we installed a Webster Moderator System.

"The results were amazing," Mr. Begam declared. "During the past two winters, with a minimum consumption of steam, heating has been very satisfactory. All sections of the store heat evenly and rapidly. On the basis of present savings, our Company should be able to amortize the entire cost of installation in three and one-half years. We consider this an excellent investment."

Jarcho Bros., Inc., of New York, acted as modernization heating contractors. There is a total of 54,000 square feet of installed direct radiation.

These before-and-after facts point the way to maximum comfort and economy in heating new buildings as well as in modernization of existing installations. Consult your architect, engineer or heating contractor. Or address

1888 WARREN WEBSTER & CO., CAMDEN, N. J. 1938
Pioneers of Modern Steam Heating
50 YEARS OF HEATING PROGRESS
Representatives in 60 principal U. S. Cities

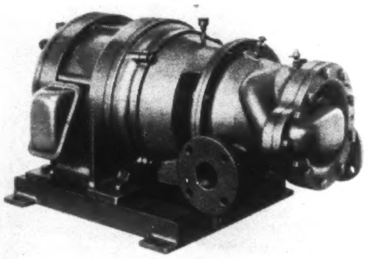
WEBSTER
MODERATOR
CONTROL
"Control by the weather"

water agitation in the presence of these penetrants often results in excessive foaming which can be prevented by the addition of one part of octyl alcohol to 20 parts of the penetrant.

"Tergitol" penetrant 7 has a slight initial odor which is dissipated on use. Evaporation of a solution containing any of these penetrants would leave practically all of the active ingredients as a residue, and hence would require little replenishing. Sodium chromate and sodium nitrite additions can be used to inhibit such slight corrosion as may be evinced by certain metals.—Carbide and Carbon Chemicals Corp., 30 E. 42nd St., New York, N. Y.

Pumps for Air Conditioning Service

No. 1479—New 2½" x 1½" two stage "SSUnit" type pump is good for heads up to 525 ft at 3550 revolutions. This pump has an efficient capacity range of from 50 to 100 gpm against heads of from 300 to 500 ft, says the maker. It is bolted to the motor frame by a splash proof connection piece, the impellers being mounted on the special motor shaft extension, and the motor bearings also being the pump bearings.

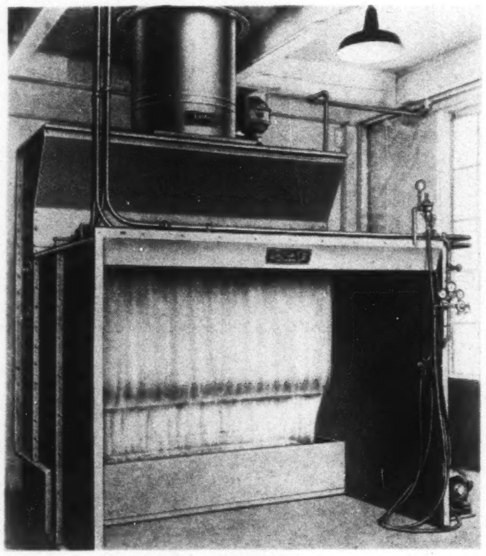


This pump is available with motors of from 10 to 30 hp of the standard squirrel cage type, splash proof or explosion proof types, and is adaptable for small boiler feed pumps, humidifier pumps in textile mills, air conditioning service, house pumps, small mine pumps, oil gathering, loading and small pipe line pumps and other small capacity, high pressure services—Allis-Chalmers Mfg. Co., Centrifugal Pump Div., Milwaukee, Wis.

Spray Booth Unit Uses New Principle

No. 1480—The new "Dynaprecipitor" has been developed to take the place of the ordinary water wash chamber for spray booths. Using a new principle in the cleaning of paint fumes, the unit reclaims all types of paints, synthetic enamel, vitreous enamel, etc., says the maker. It has no nozzles to clog or wear out, gives efficient elimination of paint pigments from spray fumes, and is economical to operate.

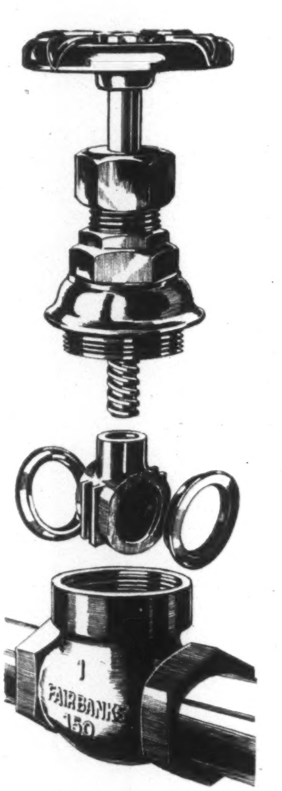
It is equipped with a special set of precipitator plates which are self cleaning. Another feature is the water curtain which extends the full width of the spray booth. The paint pigments which strike this curtain are washed down into the collecting pan, thereby eliminating the necessity of cleaning the front surface of the unit.



The same manufacturer also announced last month new twin paint and air hose, a new spray gun for heavy materials, and new multiple oil and water extractors for compressed air lines. — Binks Mfg. Co., 3114-40 Carroll Ave., Chicago, Ill.

DARLING, PLEASE HURRY HOME, I'M ALL READY TO GO TO THE PARTY
SORRY HONEY, I'LL HAVE TO WORK AGAIN TONIGHT TO REPAIR LEAKY VALVES

Don't Work While Others Play



Are you content to continue the drudgery of working nights and holidays to repair leaky valves, while others are out enjoying themselves? If not, you can rid yourself of over-time work just as thousands of others have done—by using quick-and-easy-to-repair Fairbanks Renewable Valves.

Then, too, you won't have to do the back-breaking work of removing pipe coverings and taking out a length or more of pipe in order to get leaky valves out of the line and install new ones. In a few minutes you can replace worn seats or wedges without removing valves from the line.

And you won't have complaints from the front office that you are spending too much for new valves. For new parts for the "Fairbanks" cost only a few cents.

Try a few Fairbanks "Renewables." You'll regret you didn't use them long ago.

Distributors everywhere sell Fairbanks Bronze and Iron Valves in types and sizes to meet practically every requirement.

Write for Catalog 21.

THE FAIRBANKS COMPANY
Valves, Dart Unions, Hand Trucks and Wheelbarrows
396 Lafayette St., New York, N. Y.
Boston Pittsburgh Distributors in Principal Cities
Factories: Binghamton, N. Y. Rome, Ga.

Fairbanks
Renewable Valves

The Welded Steel Burnham is made in our own separate plant at Geneva, New York. Made in 19 sizes ranging in capacities from 1,800 to 42,500 sq. ft.

The Twin Sectional Cast Iron. Aside from its economy advantages, permits of replacements, without any tear-outs. No part is too big to pass through the average size door. Made in 9 sizes. Rates from 7,850 to 19,450 sq. ft. of E.D.R. Steam Rating. Water from 12,000 to 31,800 sq. ft.

When Either, Is Neither and Neither, Is Either

When a feller sez such talk as that either-neither stuff, kinder sounds like he ought to go and have his head felt of. But I ain't a going to, yet a while.

What I wuz trying to say, is that we Burnham folks ain't playing politics when it cums to which boiler to vote fur, cast iron or steel.

We back up either one, when we know it's the right one to back fur a particular job.

Being as how we make both kinds, we don't have to do any fancy lieing, to tell the truth, as we might have to, if we only had one kind ter sell.

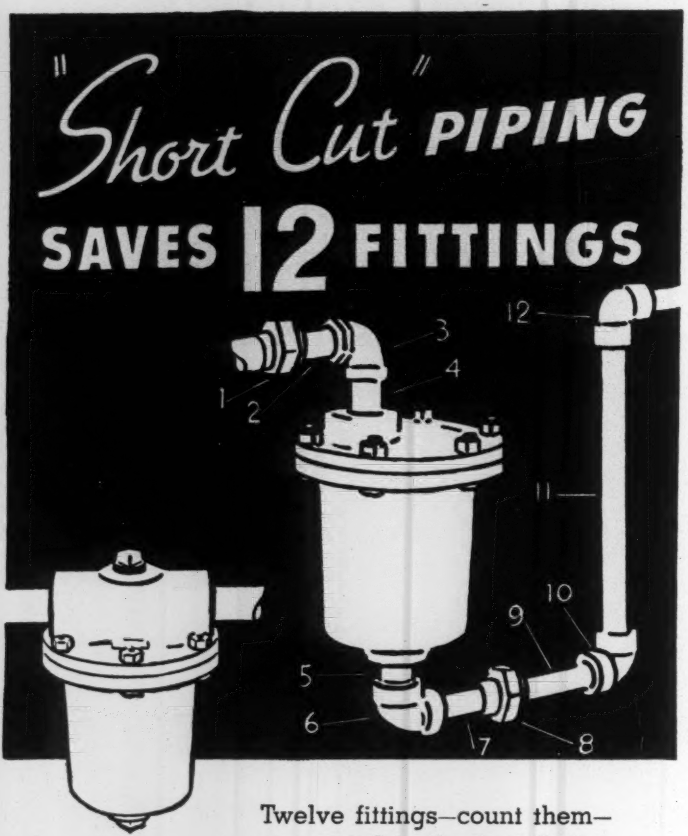
All that keeps us awake nights, is that somehow you might not get a Burnham. Then you'd be sorry forever afterward and maybe too, so would the feller who paid the bill. So you'd better take seriously my either-neither stuff.

HANK HINDLE

Burnham Boiler Corporation
Irvington, New York
Zanesville, Ohio

Export Department, 50 Church Street, New York City
Manufacturers of Heating Equipment Since 1873

Burnham Boiler



Twelve fittings—count them—are saved in the installation shown above by using an Anderson Super-Silvertop steam trap instead of an ordinary trap. This saving is due to the unique design of Super-Silvertop that permits straight-in-line piping or "short-cut" piping, instead of run-around piping.

In both cases above, the trap is an inverted bucket steam trap, but "short-cut" piping with Anderson Super-Silvertop gives a worthwhile saving in fittings.

Another feature of Anderson Super-Silvertop design is the longer lever arm which permits a larger valve orifice, hence an increased trap capacity. Then too, the smooth drilled passages insure positive handling of dirt and scale. That is why no strainer is necessary with Anderson Super-Silvertops.

Find out about the many other savings you can realize with Anderson Super-Silvertops—write for complete details.

THE V. D. ANDERSON CO.
1949 WEST 96th STREET • CLEVELAND, OHIO

You can send me that complete information on Super-Silvertops. If it shows me how to save money, I'm interested.

Name..Company..

Address..City and State..

Book Reviews

Design and Shop Practice Handbook

["Kent's Mechanical Engineers' Handbook—Design. Shop Practice," by Robert T. Kent, editor-in-chief, with the collaboration of a staff of specialists. Vol. 3 of the Wiley Engineering Handbook series. 11th ed. 1938. 1378 pp., 5½x8⅜ in., flexible binding. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price, $5.00.]

The first two volumes of the Wiley engineering handbook series—Vol. 1: Handbook of Engineering Fundamentals, and Vol. 2: Kent's Mechanical Engineers' Handbook (Power)—have been noted in previous issues. The present volume is devoted to design and shop practice, and No. 4 is to be on electric power, and No. 5 on communication and electronics.

This handbook series is distinguished by the logical arrangement of the subjects treated, and the well organized sections separately numbered. The many tables and graphs, as well as the other data, are presented with exceptional clarity.

The principal divisions of the present design and shop practice volume are as follows: General properties of materials; iron and steel; corrosion and corrosion resistant metals; non-ferrous metals and alloys; non-metallic materials; fabricated materials; strength of materials; mechanism and mechanics; fastenings; mechanical springs; rotating members; keys, cotters, pins, tapers and fits; bearings and lubricants; gearing; control mechanisms; vibration and noise; structures and buildings; industrial heating processes; forging practice; foundry practice; machine shop; woodworking; materials handling; mechanical power transmission; electric motors and their control; miscellaneous shop equipment (dust collection and illumination); safety engineering; and mathematical tables.

Law for Engineers and Architects

["Law for Engineers and Architects," by Laurence P. Simpson, Professor of Law, New York University, and Essel R. Dillavou, Assistant Professor of Business Law, University of Illinois. 2nd ed. 1937. 692+xv pp., 5¾ x 9 in., bound in maroon fabrikoid. Published by West Publishing Co., St. Paul, Minn. Price, $4.50.]

The authors present text and case material stating and illustrating the fundamental principles of law in those branches which bear most directly upon engineering. In this new edition the amount of explanatory text has been increased. The rules of law which govern a particular subject are stated at the heading of each section, followed by amplifying and explanatory text material. After this, such cases as are necessary to illustrate how the rules are applied in actual situations are presented.

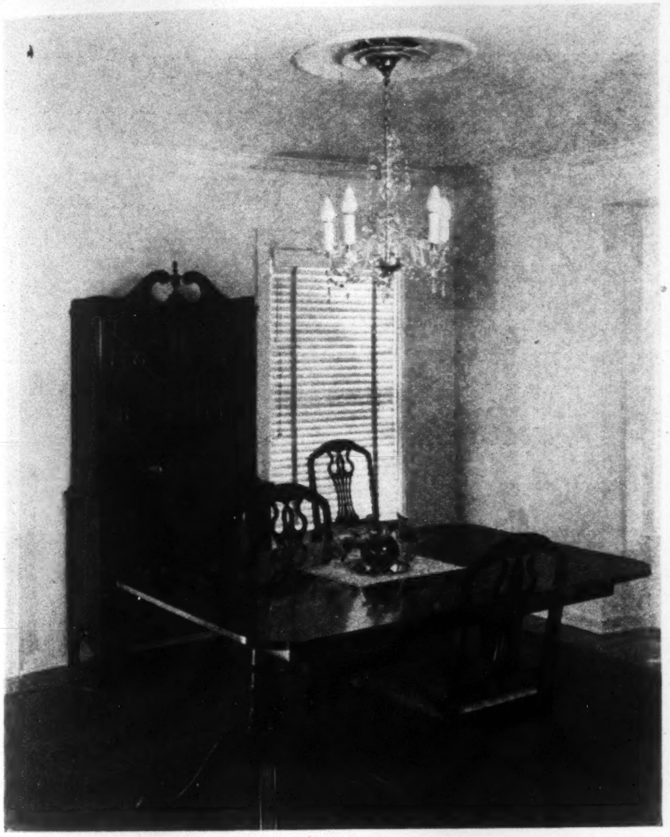
Sections are included on law in general, contracts, agency, mechanics' liens, negotiable instruments, sales, property, and workmen's compensation. Standard forms of construction contracts, invitations to bidders, sub-contracts, contracts between architect and owner, etc., are included for reference and comparison purposes.

Handbook on Gas Heating

["Comfort Heating—An Engineering Handbook for House Heating and Direct Heating Salesmen," prepared by a committee of which C. George Segeler was chairman. 81 pp., 8 x 11 in., plastic comb binding, with pages punched for three ring binder. Published by American Gas Association, 420 Lexington Ave., New York, N. Y. Price, $2.00 per copy on single orders.]

This is essentially an engineering handbook for house heating and direct heating salesmen, dealing with the use of gas in domestic and commercial installations. It is not intended to be comprehensive in its engineering treatment, but has been designed to reduce the engineering work to a minimum and to

Draftless Air Distribution



A RESIDENCE IN DALLAS, TEXAS

Christensen & Christensen
Architects

Leslie S. Gilbert, Esq.
Consulting Engineer

RESIDENTIAL AIR CONDITIONING

The ultimate in modern residential design is achieved when architect and engineer appreciate their respective problems and combine to obtain functional beauty. Residential Air Conditioning is not perfect unless drafts are eliminated and the temperature equalized. ANEMOSTATS are incorporated in the installation of the Residence shown above. The rooms are free from annoying drafts—the temperature is the same in the center of the room as in the remotest corner. The illustration shows an Anemostat combined with a light fixture.

The ANEMOSTAT is an accepted scientific achievement. It has solved major problems of the Air Conditioning Industry by reducing the speed of air flow to such an extent that it is no longer perceptible as a draft and by mixinq room air with conditioned air within the device. Its use, therefore, permits greater temperature differentials, smaller ducts, smaller plants, lower installation and operating costs. The Anemostats can be applied to existing systems as well as to new installations.

INSTALLATION DATA FOR ROOM ILLUSTRATED ABOVE

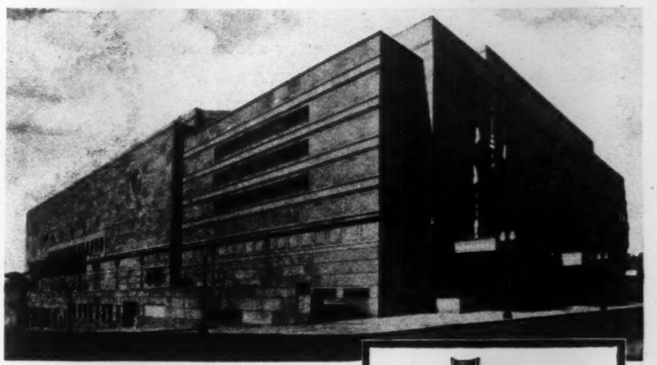
Length of Room—14'
Width of Room—13'-6"
Height of Ceiling—8'-3"
Neck Diameter of Anemostat—8"

Diameter of Largest Cone—20"
Volume of Air Distributed—225 cfm
Velocity in Neck of Anemostat—650 fpm
Temperature Differential for Heat—55°

ANEMOSTAT CORPORATION OF AMERICA
10 EAST 39TH STREET, NEW YORK

ANEMOSTAT

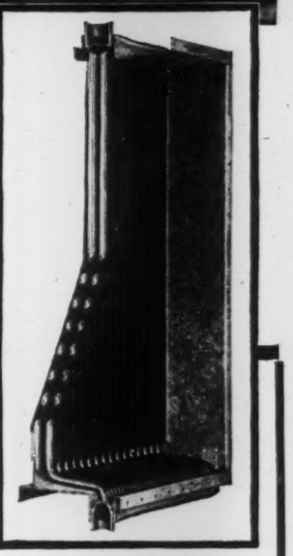
"No Air Conditioning System is better than its Air Distribution"



MUNICIPAL AUDITORIUM
KANSAS CITY, MISSOURI

Architects: *Alonzo H. Gentry, Voscamp & Neville, Kansas City, Mo.* Associate Architects: *Hoit, Price & Barnes, Kansas City, Mo.* Mechanical Engineer: *W. L. Cassell, Kansas City, Mo.*

This six and one-half million dollar public building is an excellent example of the new trend in American architectural and structural design. Modine Blast Heaters are part of its heating and ventilating equipment.



MODINE BLAST HEATER

stronger structurally

Avoid the risk of blast heater failure. Replacement is costly . . . in money, time and inconvenience.

Infinitely stronger . . . materially and structurally Modine Blast Heaters are *safely* protected against expansion strain and leaks.

The *condenser* of a Modine is *all copper or copper alloy*—headers, tubes, inlet and outlet bosses.

Cylindrical in shape for excess strength, *headers and tubes* are brazed into a single rugged unit.

Modine *patented expansion bend construction* permits free knee-joint expansion of each tube . . . individually . . . and independently of the others.

Fins are *scientifically formed* to promote greater heat transfer . . . *metallically bonded* to the tubes to prevent possibility of reduction in heat transfer.

Extremely *wide range of sizes* and types available—for *quick delivery.*

Free To ARCHITECTS ENGINEERS and CONTRACTORS

MODINE
MANUFACTURING CO.
1772 Racine Street
RACINE WISCONSIN

HEATING, COOLING, AND AIR CONDITIONING FOR INDUSTRIAL, COMMERCIAL AND RESIDENTIAL APPLICATION

Write for Catalog No. 337

provide tables which can easily be used. The objective has been to make it a working tool, concise but comprehensive enough to take the subject out of the realm of guess work.

A feature is the inclusion of tables of the capacity of convectors made by various manufacturers—data which none of the usual heating handbooks supply.

The book is attractively printed and indexed for ready reference. Chapters are given on determination of heat loss from buildings, steam and hot water heating, winter air conditioning, selecting gas heating equipment, estimating gas heating cost, competitive fuels, domestic water heating, summer air conditioning, and physical units and tables.

Conventions and Expositions

American Association of Industrial Physicians and Surgeons: Midwest conference on occupational diseases, June 6-9, Palmer House, Chicago, Ill. Convention Manager, A. G. Park, 540 N. Michigan Ave., Chicago, Ill.

American Meteorological Society: Midwest meeting, June 9-11, University of Kansas City, Kansas City, Mo.

National Warm Air Heating and Air Conditioning Association: Mid-year convention, June 13-15, Plankinton Hotel, Milwaukee, Wis. Managing Director, A. W. Williams, 50 W. Broad St., Columbus, Ohio.

Stoker Manufacturers Association: Annual meeting, June 16-17, The Homestead, Hot Springs, Va. Chairman of Convention Committee, J. E. Martin, Link-Belt Co., Chicago, Ill.

American Society of Heating and Ventilating Engineers: Semi-annual meeting, June 20-22, The Homestead, Hot Springs, Va. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

National Association of Building Owners and Managers: Annual convention, June 20-23, Hotel Schroeder, Milwaukee, Wis. Association headquarters, 134 S. La Salle St., Chicago, Ill.

American Society of Refrigerating Engineers: Food preservation conference, June 20-24, at Pennsylvania State College, sponsored by the A. S. R. E. and a number of universities. Headquarters' Office, 37 W. 39th St., New York, N. Y.

American Society of Agricultural Engineers: Annual meeting, June 27-30, Asilomar, Pacific Grove, Calif. Will include papers on air conditioning and insulation of farm buildings. Secretary, Raymond Olney, St. Joseph, Mich.

American Society for Testing Materials: Annual meeting, June 27-July 1, Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary-Treasurer, C. L. Warwick, 260 S. Broad St., Philadelphia, Pa.

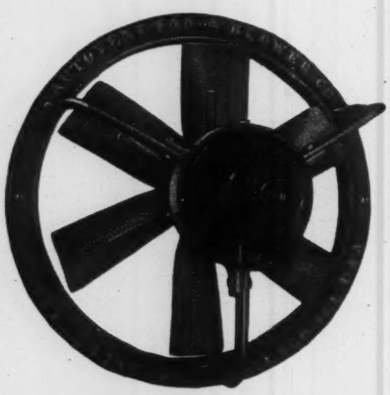
National District Heating Association: Annual convention, June 28-July 1, Lord Baltimore Hotel, Baltimore, Md. Secretary-Treasurer, William H. Sanford, 1317 Spruce St., Philadelphia, Pa.

National Industrial Advertisers Association: Annual conference, September 21-23, Cleveland, Ohio. Committee Chairman, Stanley Knisely, Advertising Manager, Republic Steel Corp., Republic Bldg., Cleveland, Ohio.

American Welding Society: Annual meeting (in conjunction with Metals Congress Exposition), October 17-21, Detroit, Mich. Secretary, M. M. Kelly, 33 W. 39th St., New York, N. Y.

American Public Health Association: Annual meeting, October 25-28, Kansas City, Mo. Headquarters Office, 50 W. 50th St., New York, N. Y.

Power Show: National Exposition of Power and Mechanical Engineering, December 5-10, Grand Central Palace, New York, N. Y. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.



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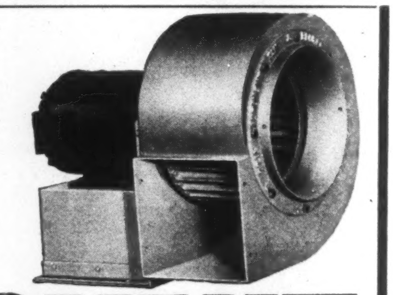

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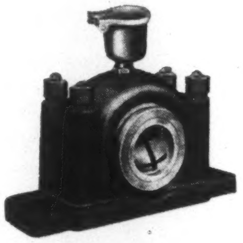

* Randall Universal Pillow Block (double reservoir). Ball can be turned so that mounting can be made in any of four positions.

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* *Shown with large special oiler.*

More than 75% of air conditioning equipment manufacturers have chosen Randall Pillow Blocks as standard on their units. This fact is substantial evidence of the long trouble-free service Randall Bearings give in the field.

Knowing that the bearings you build into your units will be free from trouble gives assurance of complete user satisfaction without complaints to contractors.

Randall Pillow Blocks are constructed of the finest materials to very high standards. They are self-aligning, self-lubricating and operate without metallic bearing noise. Their highly efficient principle of lubrication enables them to operate for long periods without attention. They are made in a variety of types and in every needed size and all can be furnished with large oil cups as shown.

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NOVOID CORK PIPE COVERING provides dependable insulation for additional air conditioning facilities in New York's famous Waldorf-Astoria. The insulation was installed by Robert A. Keasbey Company, New York City.

Properly installed on pipe lines, Novoid Cork Pipe Covering aids in maintaining uniform temperatures. Thanks to the unique cell structure of cork, Novoid forms an effective barrier to the passage of heat, and condensation cannot form on its moisture-proofed surface. As a result, Novoid Cork Pipe Covering helps air conditioning systems to operate more efficiently and more economically.

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Please send me full details of Novoid Cork Pipe Covering for air conditioning piping.

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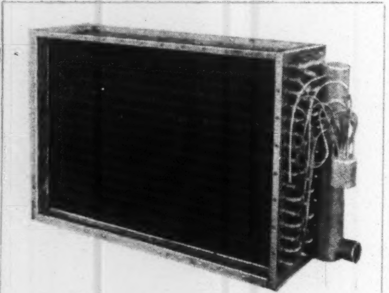

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Dependable High Pressure Construction for all applications requiring the heating of air with steam.

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For Cooling or Heating with Water. Maximum efficiency —counter flow continuous tube, serpentine construction.

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For Cooling with Direct Expansion Refrigerants. Equipped with the highly efficient McQuay Distributing Header, insuring proper distribution of refrigerant throughout the coil.

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Easy to select and install.

Write for complete descriptive bulletins and technical information.

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Offices in most principal cities.

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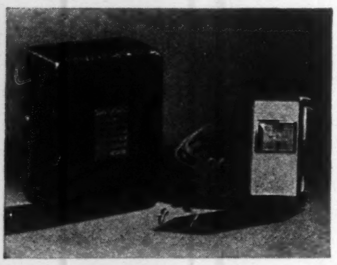
Relays
FOR THE AIR CONDITIONING INDUSTRY

These new relays are built specifically to meet the needs of automatic heat and air conditioning installations. Designed, manufactured and tested by the General Controls Co.



RS-100 RELAY . . . Handles single-phase motor loads up to 1 H.P. or heating loads up to 1.5 K.W. Uses a double-break relay and integral transformer for supplying power to small indicating lamps, wall clocks, or small sensitive relays. Normally open. Two wire.

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Lewis Institute Offers Summer Course in Air Conditioning

The department of mechanical engineering of Lewis Institute, 1951 W. Madison St., Chicago, Ill., offers a five week summer course in air conditioning beginning Monday, June 20. The course will include the theory and the application of air conditioning principles along fundamental lines, and is generally aimed to help those who wish a firm start for further work in air conditioning and refrigeration. No laboratory work will be required.

V. L. Sherman, in charge of the department of mechanical engineering, will teach the course.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 128. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING

No. 2797. AIR CONDITIONERS: Trane Co., La Crosse, Wis. 16 p. bulletin (No. S303) on "Climate Changers" describing advantages, showing installations and explaining operation and construction features.

No. 2798. AIR CONDITIONERS: York Ice Machinery Corp., Roosevelt Ave., York, Pa. 12 p. bulletin on "Yorkaire" units, describing and illustrating applications and installations, particularly in stores, shops and offices. Simplified diagrams are given.

No. 2799. AIR CONDITIONING: Westinghouse Electric & Mfg. Co., Mansfield, Ohio. Data sheets for application engineering data book on air conditioning units, heat transfer units, evaporative condensers, evaporators and chilled water units.

No. 2800. AIR FILTERS: Independent Air Filter Co., 228 N. LaSalle St., Chicago, Ill. 4 p. bulletin (No. P-405-5) on "Permo" flameproof throwaway air filters and air filter frames, with engineering and installation data and suggested specifications.

No. 2801. BEARINGS: Norma-Hoffmann Bearings Corp., Stamford, Conn. 8 p. bulletin (No. 962) on precision needle roller bearings and needle rollers recommended for cam rollers, planetary reduction gears, valve rocker shafts, pump shafts, idler gears, etc. Application and design data are included.

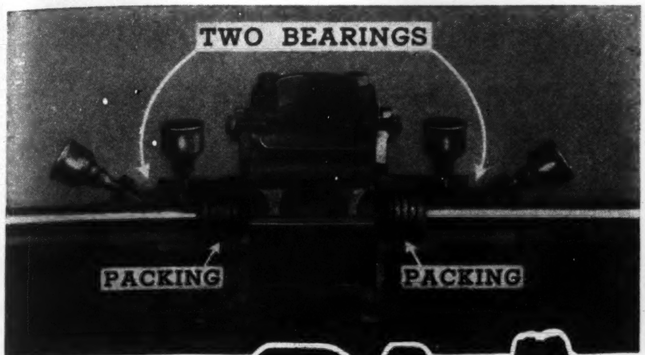
No. 2802. COOLING TOWERS: Marley Co., 3001 Fairfax Rd., Kansas City, Kans. 4 p. bulletin (No. 502) on "small series" steel induced draft cooling towers for indoor service, horizontal type. Also, 4 p. bulletin (No. 500) on vertical type towers.

No. 2803. COOLING UNITS: Frick Co., Waynesboro, Pa. 4 p. bulletin (No. 185-A) on air cooling units for cold storages, meat chilling and processing rooms, dairies, fur storages, breweries, etc., with dimension table and drawing.

No. 2804. COPPER TUBES AND FITTINGS: American Brass Co., 414 Meadow St., Waterbury, Conn. 28 p. booklet (No. C2) on "Anaconda" copper tubes and fittings for forced circulation hot water heating, including suggested method for pipe sizing, tabular data, information on installation and on heat losses of copper tubes.

No. 2805. CORROSION: Mutual Chemical Co. of America, 270 Madison Ave., New York, N. Y. 8 p. booklet on chromium chemicals as corrosion inhibitors, briefly summarizing studies and experience with them. Use in refrigeration and air conditioning is given particular attention.

No. 2806. DAMPER REGULATORS: Young Regulator Co., 4500 Euclid Ave., Cleveland, Ohio. 4 p. bulletin (No. 10), describing new remote control regulator for manual operation of dampers, with details of installations and features.



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No wonder BLACKMER Rotary Pumps give such excellent, long-time service. Note the two-bearing construction, each bearing protected by packing.

This packing keeps the pumpage SEALED IN the pump case; the bearing lubricant SEALED OUT. Thus the bearings stay lubricated—the material handled kept clean of oil or grease.

With many types and hundreds of sizes, there is bound to be a BLACKMER Pump to meet your specific needs. Profit from our 30 years' experience. BLACKMER PUMP COMPANY, 1941 Century Ave., Grand Rapids, Michigan.

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14 Models

for HANDLING
PRACTICALLY ANY
LIQUID *or* SEMI-SOLID

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- Glycerine
- Grape Juice
- Lard
- Molasses
- Naphtha
- Oils -
  - Crude
  - Lube
  - Vegetable
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The Moncrief Patented Lock Joints on wall stacks, stack heads, foot-pieces and trunk duct fittings make a more efficient, neater job that is easier to install.

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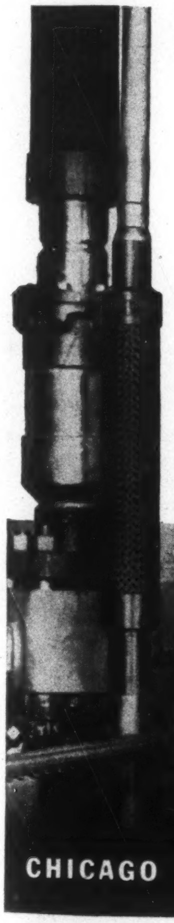

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Rex Vibra-Sorbers absorb vibration, stop noise, insure permanently quiet operation. Sweated into the compressor lines, they act as flexible couplings for speedy, trouble-free installation. All sizes available.

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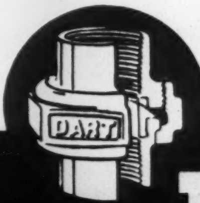

SALES AGENTS: THE FAIRBANKS COMPANY, NEW YORK AND ALL BRANCHES
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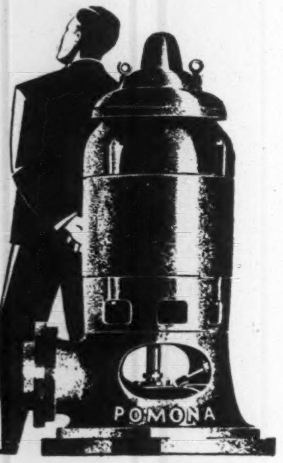
At the Pomona Pump plants the policy is to employ only good men—adequately trained, provided with the best tools and machinery, surrounded by pleasant and healthful conditions and properly paid according to ability. Every encouragement is given to ambitious workers and advancement is made according to merit. The management believes in and does everything possible to maintain a happy family of satisfied employes. Under such conditions the best work is done.

Owners of Pomona Pumps enjoy the benefits of the expression of the high ideals of the good men at each of the Pomona plants—products that have won well-deserved world-wide leadership in agriculture, industries of all kinds, mines and municipal water service.



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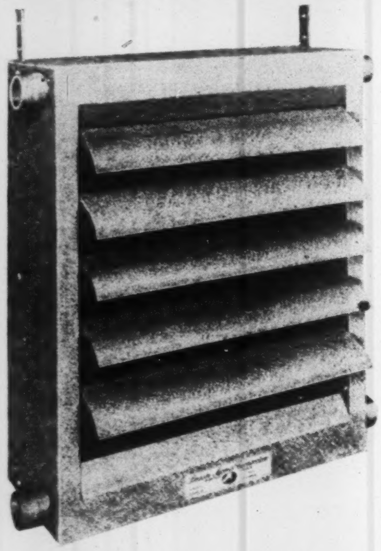

Entire heating element and fins are copper, giving greater heat transfer and preventing corrosion. Fins are straight preventing accumulations of dust. Tested to 1000 lbs. hydrostatic pressure.

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No. 2807. DRIVES: Congress Tool & Die Co., Inc., 9030 Lumpkin Ave., Detroit, Mich. 4 p. bulletin describing complete line of pulleys and flexible couplings.

No. 2808. ELECTRIC HEATING: Hynes Electric Heating Co., 240 Cherry St., Philadelphia, Pa. 8 p. bulletin (No. 12) on fan circulation electric heating systems with automatic control, with descriptions, dimensions and specifications of heaters, information on heating offices and small rooms, and on electric heating for air ducts and for the heating cycle of air conditioning systems.

No. 2809. ENGINES: Worthington Pump & Machinery Corp., Harrison, N. J. 36 p. bulletin (No. S-500-B13) illustrating various installations of diesel and gas engines, the former ranging from 50 to 1500 hp and the latter from 30 to 1800 hp.

No. 2810. EXPANSION JOINTS: E. B. Badger & Sons Co., 75 Pitts St., Boston, Mass. 8 p. bulletin (No. 200) illustrating and briefly describing various kinds of corrugated pipe expansion joints and giving price lists, dimensions and weights.

No. 2811. FANS: Emerson Electric Mfg. Co., 1847 Washington Ave., St. Louis, Mo. Pocket-size 24 p. catalog on air circulators, ceiling fans, exhaust and ventilating fans.

No. 2812. FLEXIBLE METAL HOSE: Atlantic Metal Hose Co., Inc., 123 W. 64th St., New York, N. Y. 4 p. bulletin (No. 20-A) on flexible metal hose, describing and illustrating features, suggesting applications and including a table showing hydrostatic bursting pressures.

No. 2813. FLOODED ELECTRIC EQUIPMENT: General Electric Co., 1 River Rd., Schenectady, N. Y. 18 p. booklet (No. GEA-2571B) on reconditioning flooded electric equipment, with specific instructions and recommendations.

No. 2814. GASKETS: Goetze Gasket & Packing Co., Inc., 60 Allen Ave., New Brunswick, N. J. 4 p. bulletin (No. 51) on oval and octagonal gaskets for ring joint flanges with table of dimensions and list prices.

No. 2815. GEAR MOTORS: General Electric Co., 1 River Rd., Schenectady, N. Y. 12 p. bulletin (No. GEA-1437C) with complete information on integral and fractional horsepower gear motors for low speed operation, output shaft speeds from 600 to 6 rpm, horsepower from 1/8 to 75.

No. 2816. GENERATORS AND EXCITERS: General Electric Co., 1 River Rd., Schenectady, N. Y. 4 p. bulletin (No. GEA-1607B) on direct current generators and exciters.

No. 2817. HEATERS: Hotstream Heater Co., 8007 Grand Ave., Cleveland, Ohio. 28 p. illustrated price catalog on water heaters of various types and accessory equipment. Engineering data included.

No. 2818. HEATING AND PLUMBING: Crane Co., 836 S. Michigan Ave., Chicago, Ill. 32 p. booklet on heating and plumbing equipment for industrial and commercial buildings.

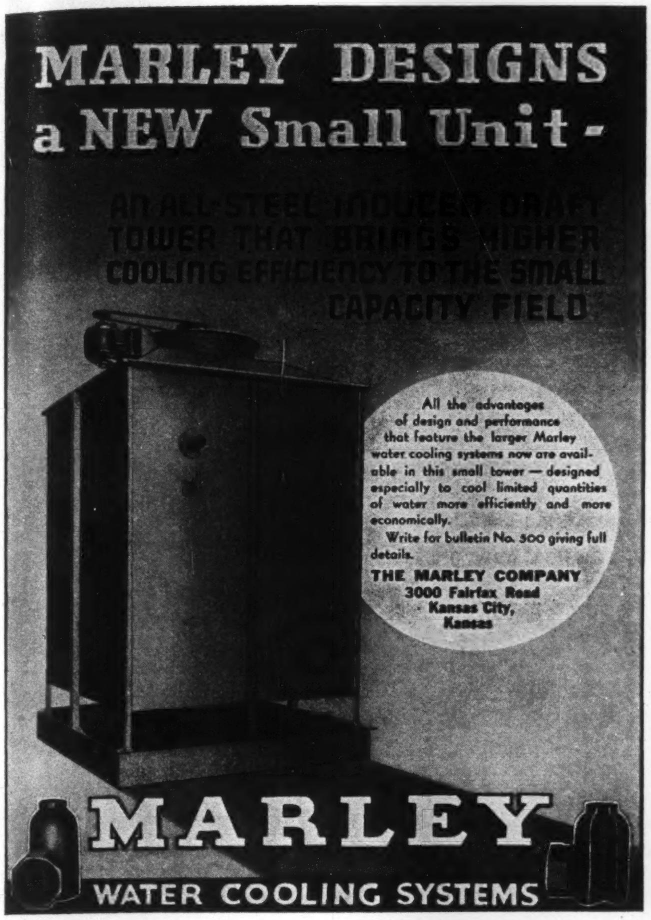
No. 2819. HOTEL AIR CONDITIONING: Trane Co., La Crosse, Wis. Issue of "Weather Magic" (Vol. 2, No. 2) with description of how the Palmer House, Chicago, purchased air conditioning equipment. Another article gives information on apartment house air conditioning.

No. 2820. INSTRUMENT BOARDS: Foxboro Co., 106 Neponset Ave., Foxboro, Mass. 22 p. bulletin (No. 223) describing standard practice in control board design, showing typical layouts and giving suggested layouts. Helpful data on equipment are included.

No. 2821. INSULATION: Armstrong Cork Products Co., 994 Concord St., Lancaster, Pa. Issue of the "Insulator" (Vol. 8, No. 2), including information on air conditioning in Washington, D. C., and the use of cork insulation for ducts and piping.

No. 2822. INSULATION: Hinde & Dauch Paper Co., Sandusky, Ohio. 14 p. bulletin on "Ideal" air cell insulation with data on how to install it, and including typical specifications.

No. 2823. INSULATION: Mikolite Co., 1100 S. Mill St., Kansas City, Kans. 16 p. booklet on mineral insulation of mica origin available in various types and including data on loose fill insulation, insulating plaster, acoustical plaster, insulating



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AN ALL-STEEL INDUCED DRAFT TOWER THAT BRINGS HIGHER COOLING EFFICIENCY TO THE SMALL CAPACITY FIELD

All the advantages of design and performance that feature the larger Marley water cooling systems now are available in this small tower — designed especially to cool limited quantities of water more efficiently and more economically.

Write for bulletin No. 500 giving full details.

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MARLEY
WATER COOLING SYSTEMS

LET THIS
New Type of Craftsman

CUT YOUR SERVICE AND INSTALLATION COSTS

Quality equipment properly installed and correctly serviced is a winning combination you can always depend on to bring that satisfied customer's recommendation so valuable to every business. You've *always* been able to control the quality of your equipment; and NOW *you can control the quality* of your installation and service work.

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The individual qualifications of each man trained by the Refrigeration & Air Conditioning Institute is recorded in a form which enables you to select, at a glance, the man best suited to your needs. . . . Mr. Employer, will you let us shoulder your *Training Costs* and help you solve your man-power problem?

MORE THAN 100 LEADING MANUFACTURERS "OFFICIALLY" ENDORSE AND RECOMMEND THIS TRAINING PROGRAM

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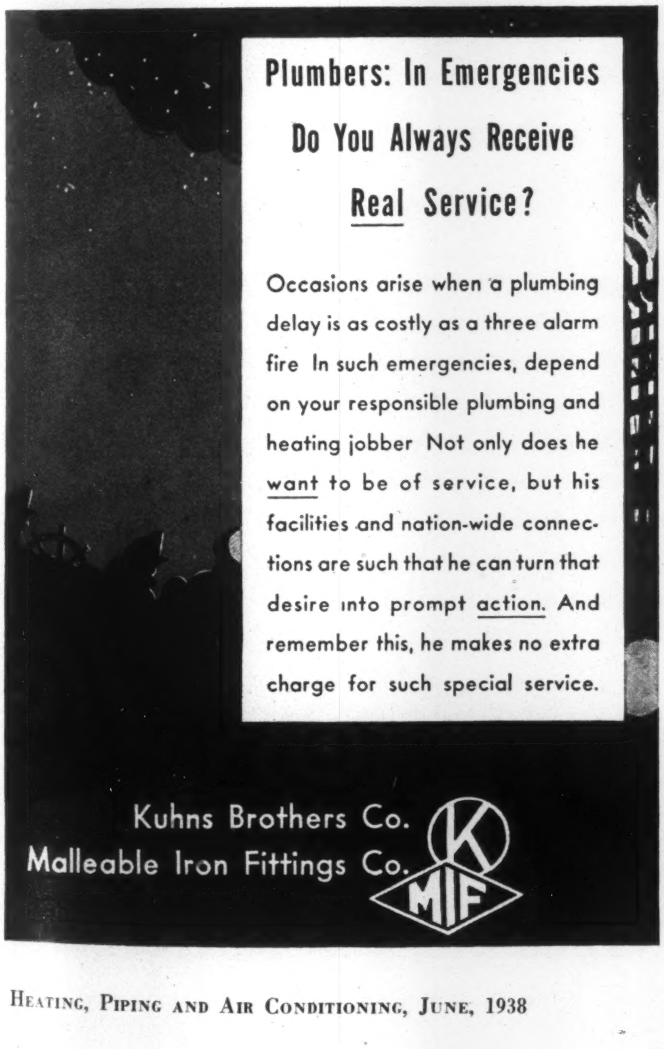

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Real Service?

Occasions arise when a plumbing delay is as costly as a three alarm fire In such emergencies, depend on your responsible plumbing and heating jobber Not only does he want to be of service, but his facilities and nation-wide connections are such that he can turn that desire into prompt action. And remember this, he makes no extra charge for such special service.

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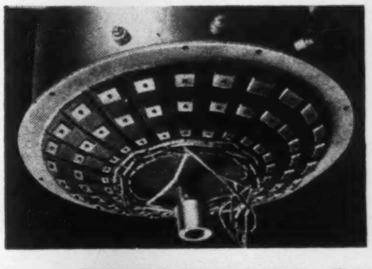
To apply **ELECTRIC HEAT**
to a circular, convex tank bottom



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STRIP HEATERS

Engineers and industrial executives find the Chromalox Catalog and Handbook of Electric Heat of constant value for reference. Your request brings a copy.

These units are available flat, or curved to fit a dished bottom of kettle or tank, as illustrated above. They are clamped tightly into place by means of studs welded to the tank bottom, and projecting through holes in each strip heater.

This method provides not only a very neat installation but also every advantage of electric heat, with its automatic close temperature control and operating economy.

This is only one of many types of Chromalox electric heating units, each designed for some specific industrial heating need.

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cement and asphalt roofs, cold storage insulation, waterproofing, and high temperature insulation.

No. 2824. INSULATION: Sprayo-Flake Co., 2715 Irving Park Blvd., Chicago, Ill. 12 p. bulletin giving technical data and specifications for sprayed-on insulation, with information on applications, characteristics, heat transfer of various types of construction, thermal insulation, acoustic treatment, duct insulation and insulation of steel industrial buildings.

No. 2825. LOW WATER CUT-OFFS: McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill. 4 p. bulletin announcing new low water cut-off, new electric water valve, and new pressure limit control, with detailed descriptions of features and applications.

No. 2826. MILLIVOLTMETER PYROMETERS: Bristol Co., Platts Bridge, Waterbury, Conn. 12 p. bulletin (No. 488) on millivoltmeter pyrometers, including indicator controllers with enclosed mercury contacts or solid metal to metal contacts, single point indicators, and multi-point indicators.

No. 2827. MOTORS: Baldor Electric Co., 4353 Duncan Ave., St. Louis, Mo. 12 p. bulletin (No. 200) on "Stream-cooled" motors (in integral sizes, single phase, polyphase, and direct current) which are totally enclosed and cooled by a constant stream of air blowing over entire exterior of frame.

No. 2828. MOTORS: General Electric Co., 1 River Rd., Schenectady, N. Y. 4 p. bulletin (No. GEA-1542C) on constant speed direct current motors 1 to 7½ hp, and adjustable speed motors ½ to 3 hp.

No. 2829. MOTOR SWITCHES: General Electric Co., 1 River Rd., Schenectady, N. Y. 4 p. bulletin (GEA-2889) on magnetic motor starting switches and push buttons for full voltage starting of a-c motors, with ratings and prices.

No. 2830. OIL HEATING: Harvey-Whipple, Inc., Springfield, Mass. Manila file folder with data for architects, builders, and heating men on "Master Kraft" oil burners, oil furnaces and other equipment. Also a folder on an improved control, explaining how it functions in case of trouble in ignition circuit of oil burners.

No. 2831. PIPE CUTTING AND THREADING: Curtis & Curtis Co., 450 Garden St., Bridgeport, Conn. 12 p. booklet on pipe cutting and threading machines, illustrating and describing the various types.

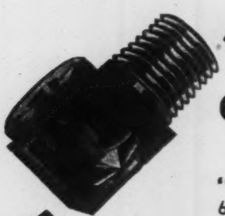
No. 2832. PIPE LINE SEALS: E. B. Badger & Sons Co., 75 Pitts St., Boston, Mass. 4 p. bulletin on pipe line flexible seals for sealing pipes through foundations and walls, and for sealing pipes through bulkheads and decks in marine service.

No. 2833. PRESSURE AND TEMPERATURE CONTROLLERS: Mason-Neilan Regulator Co., 1190 Adams St., Boston, Mass. 8 p. bulletin (No. 2500-D) on indicating pressure and temperature controllers, describing and illustrating features, operation, and applications, and giving data on ordering.

No. 2834. PUMPS: Ingersoll-Rand Co., 11 Broadway, New York, N. Y. 16 p. bulletin (No. 7069) on "Cameron" centrifugal pumps of end suction type, built in capacities up to 1000 gpm for heads up to 500 ft.

No. 2835. RECORDING THERMOMETERS AND GAGES: Mason-Neilan Regulator Co., 1190 Adams St., Boston, Mass. 44 p. bulletin (No. 3010) on recording thermometers and pressure gages, and indicating thermometers, with detailed information on features and construction, and selection data. Accessory equipment is described.

No. 2836. SOUND CONTROL: Johns-Manville, 22 E. 40th St., New York, N. Y. 18 p. booklet on sound control of mechanical equipment, presenting selected data sheets describing "J-M" materials and giving information for specific applications.



AIR CONDITIONING SPRAYS

¼" Fig. 629

"Non-Clogging": Fig. 629 and Fig. 631 (female) produce a fine, soft, evenly distributed spray. Contain no internal parts or slots to wear or clog. Capacities from 4.0 g.p.h. up.

¼" Fig. H-261

"Perfection": Fig. H-261 and F-27 (female) are made in capacities from .57 g.p.h. up.

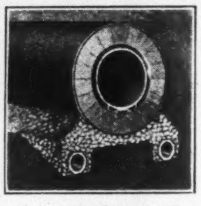
CATALOG 6-A

MONARCH MFG. WKS., INC.
2728 E. WESTMORELAND ST., PHILADELPHIA, PA.

NOW 288 REMPE UNIT COOLERS

72 MORE types of Rempe Units have just been added to the line to make it STILL more complete! You can depend on Rempe for units for any temperature, any refrigerant, any condition. Write for complete data.

REMPE CO. 340 N. Sacramento Blvd. CHICAGO


ADSCO CASING

"Red Diamond Brand" Casing is the ideal combination conduit *and* insulation for underground steam and hot water lines. Rapid installation and low labor cost obtained through use of five to eight foot sections — 91% efficient.

Also available in split form.

Write for Bulletin No. 35-65HP

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS

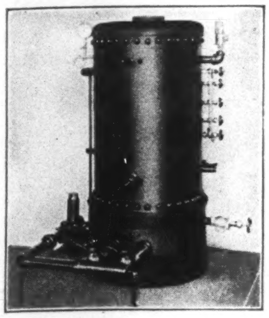
Rugged

Rugged, rigid construction is just one of the many characteristics which distinguish Torrington Blower Wheels for long-lasting, efficient operation. Their sturdy, patented design breaks up resonance and minimizes noise—assures continued smoooth and quiet operation confirmed by guaranteed laboratory tests made under the most extreme conditions.

Single and double unit wheels available in sizes 3" to 15" diameter in all standard widths.

TORRINGTON BLOWER WHEELS

TORRINGTON MFG.CO. TORRINGTON CONN. U.S.A.



. . . not the best Boiler we make, BUT A BETTER BOILER, AT THE PRICE, THAN YOU CAN FIND 'MOST ANYWHERE!

MKAYO

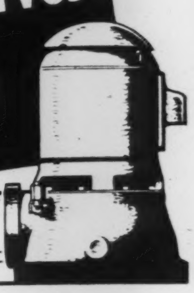
GAS-FIRED BOILER

We built the MKAYO to meet the demand for a small, unjacketed and very inexpensive automatic steam boiler . . . but we put into it craftsmanship and quality materials you'd expect to find only in a far more costly job. The MKAYO is efficient, economical to operate, dependable and it's readily adaptable to many, many requirements. Sizes 1 to 5 H. P.—approved for working pressures of 100 lbs. Literature—yours, upon request and without obligation.

MEARS-KANE-OFELDT INC.

Executive Office and Factory
1903-1915 EAST HAGERT ST., PHILADELPHIA
Branch Offices or Distributors in Principal Cities

A good well deserves the best pump



PEERLESS PUMPS

WHY IT PAYS TO BUY A PEERLESS

BECAUSE Peerless is one of the world's largest manufacturers of deep well turbine pumps.

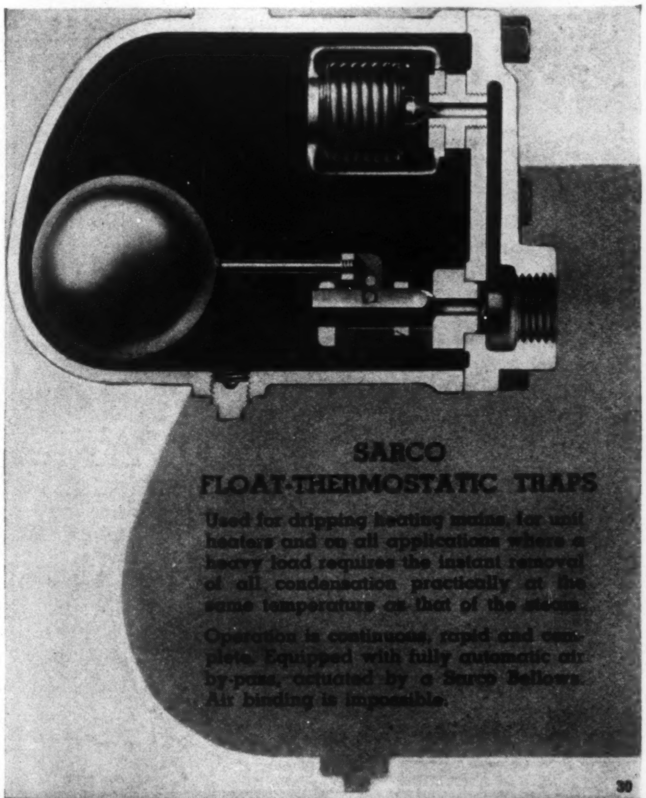
BECAUSE Peerless laboratories have developed many exclusive improvements in design that result in high maintained efficiency and a trouble-free pump which is making sensational performance records.

BECAUSE Peerless uses the finest materials and precision manufacturing methods to give you a pump that will last many years longer than the average.

. . .

For just a little difference in price, you can equip your well with a Peerless, the pump that has met the most exacting demands for over thirty years.

PEERLESS PUMPS
FOOD MACHINERY CORPORATION
Massillon, Ohio
Los Angeles, Calif. *San Jose, Calif.*



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FLOAT-THERMOSTATIC TRAPS

Used for dripping heating mains, for unit heaters and on all applications where a heavy load requires the instant removal of all condensation practically at the same temperature as that of the steam.

Operation is continuous, rapid and complete. Equipped with fully automatic air by-pass, actuated by a Sarco Bellows. Air binding is impossible.

COMPLETE SYSTEMS FOR HEATING AND INDUSTRY

SARCO

REPRESENTATIVES IN ALL PRINCIPAL CITIES

THERMOSTATIC, FLOAT AND BUCKET TRAPS, REGULATORS AND HEATING SPECIALTIES
SARCO COMPANY, Inc., 183 MADISON AVENUE, NEW YORK, N. Y.
SARCO CANADA LIMITED, FEDERAL BLDG., TORONTO, ONT.

Quicker! Cleaner! Lower Cost Pipe Cutting with this remarkable RIDGID Wheel-Blade Cutter . . .

Because every RIDGID tool is designed to save you bother and expense old-fashioned tools cause you, the millions of them now in use have saved billions of hours that used to be wasted.

That's true of this cutter. The thin bladed wheel — coined out of tool steel, hammered, heat-treated and assembled in a solid hub — has the extra stamina to keep on rolling readily cleanly through all kinds of pipe long after ordinary cutter wheels need replacing. And the housing is guaranteed warp-proof — always cuts true, twirls easily to your pipe size.

Try this tool of the smart buyer and the expert user. Save yourself time and expense with the RIDGID Cutter that gives you far more cuts per wheel-blade. Buy from your Jobber — now.

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Makers of the Famous RIDGID Wrench

RIDGID PIPE TOOLS

For Your Convenience

Heating, Piping and Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [6-38]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

1469	1470	1471	1472	1473	1474	1475
1476	1477	1478	1479	1480		
2797	2798	2799	2800	2801	2802	2803
2804	2805	2806	2807	2808	2809	2810
2811	2812	2813	2814	2815	2816	2817
2818	2819	2820	2821	2822	2823	2824
2825	2826	2827	2828	2829	2830	2831
2832	2833	2834	2835	2836	2837	2838
2839	2840	2841	2842	2843	2844	2845
2846						

Name.................................... Title.............

Company ....

Address ....

City.................................... State.............

including duct insulation and anti-vibration platforms for air conditioning equipment.

No. 2837. STEAM CLEANING: Homestead Valve Mfg. Co., Inc., P. O. Box H, Coraopolis, Pa. Folder describing "Hypressure Jenny," a steam vapor spray cleaner, illustrating and briefly describing its industrial uses.

No. 2838. UNIT COOLERS: Rempe Co., 340 N. Sacramento Blvd., Chicago, Ill. 4 p. bulletin on unit coolers available in a line of 216 different sizes and types for low temperature cooling down to 11 deg, for comfort cooling, and for various refrigerants and air flows.

No. 2839. UNIT HEATERS: Beacon-Morris Corp., 702 Beacon St., Boston, Mass. 12 p. catalog (No. 1001) on unit heaters, describing construction features, and giving capacity tables, dimensions and recommended piping arrangements.

No. 2840. VALVES: Crane Co., 836 S. Michigan Ave., Chicago, Ill. 8 p. booklet giving the "inside story" of plug disc globe and angle valves, with a table listing the essential characteristics of each of the manufacturer's plug disc valves.

No. 2841. VALVES: Edward Valve & Mfg. Co., Inc., 1200 W. 145th St., East Chicago, Ind. 12 p. issue of "Valve Valves" (May, 1938) with information on tests of steel under elevated temperatures, bolting, boiler valves, etc.

No. 2842. VALVES AND FITTINGS: Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill. 24 p. condensed catalog (No. 88-G) on valves, fittings, tools, and accessories for refrigeration and air conditioning, describing more than 250 different items in a complete range of sizes.

No. 2843. V-BELTS: Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J. 4 p. bulletin (No. 6868) describing "Condor Whipcord" V-belts, including list prices and a V-belt comparison table.

No. 2844. VISE STAND AND PIPE BENDER: H. P. Martin & Sons, 801 W. 12th St., Owensboro, Ky. Folder describing portable vise stand and pipe bender, illustrating and briefly describing features and advantages.

No. 2845. WALL AND ARCH CONSTRUCTION: Geo. P. Reintjes Co., 2517 Jefferson St., Kansas City, Mo. 16 p. bulletin on fundamental principles underlying development of and need for supported walls and arches in boilers and furnaces. Detailed illustrations and descriptions of the manufacturer's form of construction are presented.

No. 2846. WELDING PIPING: Metal & Thermit Corp., 120 Broadway, New York, N. Y. 12 p. bulletin (No. 20) on arc welding of piping for operation at pressures up to 1500 lb per sq in. and temperatures to 1000 F.

Do you know ANY other
Duct Insulation that equals this in
EFFICIENCY plus PRACTICALITY?

- Thermal Conductivity only 0.246 B. T. U.'s! . . . Permanent . . . fire and moisture resistant . . . won't rot or decay . . . repels vermin . . . shapes perfectly to ducts . . . easy to apply.

For Samples and Data Write to

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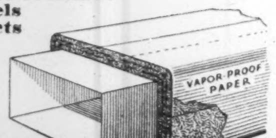
Ozite HAIR FELT
AIR DUCT INSULATION



FILTER PANELS

- 99.3%—99.8% Efficient
- Easily Cleaned and Charged
- Very Low Pressure Drop
- No Replacements Needed
- Long, Economical Service

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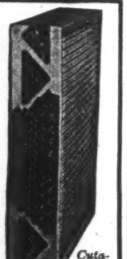
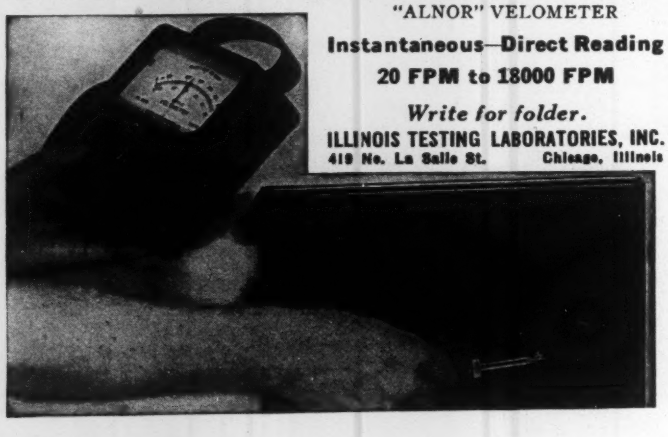
AIR-MAZE CORP. • 820 HURON RD. • CLEVELAND
Air-Maze is in the A.S.H. & V.E. 1938 Guide Book

AIR-MAZE
CLEANABLE AIR FILTER PANELS



AN ALL PURPOSE AIR VELOCITY METER
"ALNOR" VELOMETER
Instantaneous—Direct Reading
20 FPM to 18000 FPM
Write for folder.
ILLINOIS TESTING LABORATORIES, INC.
419 No. La Salle St. Chicago, Illinois



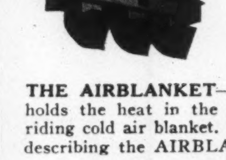
The Airtherm Line of Unit Heaters is Complete
A Full Range Of Capacities
In All Types

THE AIRVECTOR—a newly redesigned propeller fan type unit heater backed by 30 years of manufacturing experience.

THE AIRHEATOR—Large capacity blower type unit heaters for floor, wall and ceiling mounting.

THE AIRBLANKET—a revolutionary type of heating unit which holds the heat in the working zone through the use of an overriding cold air blanket. Write for your copy of "The Final Chapter" describing the AIRBLANKET in detail.

AIRTHERM MFG. COMPANY
1478 S. VANDEVENTER AVE., ST. LOUIS, MO.
THE ENGINEERED LINE OF UNIT HEATERS



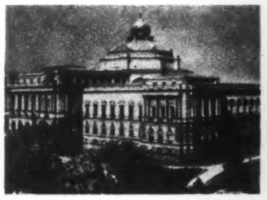
WHEN WASHINGTON SWELTERS

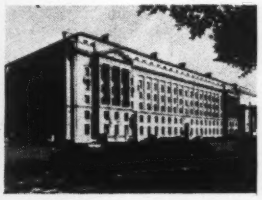
Capitol of the United States. Carrier Corporation, Syracuse, N. Y., *Contractor;* Charles S. Leopold & George Weschler, *Consulting Engineers.* "Freon" air conditioning by Carrier Corporation.

12,000 TONS OF "FREON"*

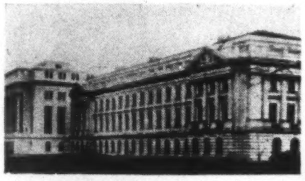
AIR CONDITIONING *keep government buildings cool!*

Library of Congress Addition (right)—Jacobsen Bros., Chicago, *Contractor.* Peerson & Wilson, *Architects and Consulting Engineers.* "Freon" refrigeration for air conditioning by York Ice Machinery Corporation.



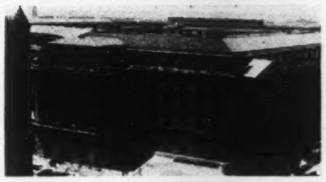


Department of Justice Building (left) — G. A. Fuller Co., *Contractor;* I. H. Francis, *Consulting Engineer.* "Freon" refrigeration for air conditioning equipment by York Ice Machinery Corporation.

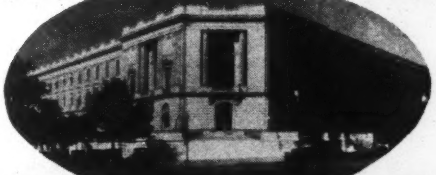


Dep't of Agriculture (Administration Bldg.) (left)—Riggs Distler, *Contractor.* Designed by Nat'l Park Service. Charles Leopold, *Consulting Engineer.* "Freon" air conditioning by Frick Co.

Post Office Building (right)—McCloskey & Co., *Contractor;* Mehring & Hansen. *Sub-Contractors;* Syska & Hennessey, *Consulting Engineers.* "Freon" refrigeration for air conditioning by York Ice Machinery Corporation.

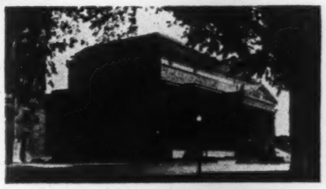


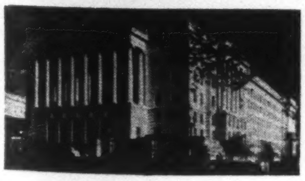
Department of Interior Building (Old) (below)—National Park Service, *Consulting Engineer.* Contractor and manufacturer of "Freon" air conditioning equipment—York Ice Machinery Corporation.



Archives Building (below)—G. A. Fuller Co., *Contractor;* Clyde R. Place, *Consulting Engineer.* "Freon" air conditioning equipment by York Ice Machinery Corporation.

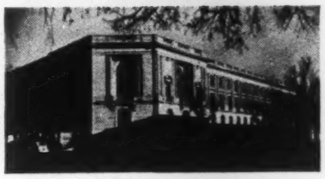
Senate Office Building (above)—G. A. Fuller Co., *Contractor;* Charles S. Leopold & George A. Weschler, *Consulting Engineers.* "Freon" refrigeration by York. Additional air conditioning by Raisler Heating Co.





New House Office Building (left)—Pennsylvania Engineering Co. of Philadelphia, *Contractor;* Charles S. Leopold & George Weschler, *Consulting Engineers.* "Freon" air conditioning by Pennsylvania Engineering Co.

Old House Office Building (right)—Pennsylvania Engineering Co. of Philadelphia, *Contractor.* Charles S. Leopold & George Weschler, *Consulting Engineers.* "Freon" air conditioning by Pennsylvania Engineering Co.



THE world's largest refrigerating machinery installation for air conditioning cools the Capitol group of buildings in Washington, D. C. Six 800-ton York units, using "Freon-12" refrigerant, give it a total capacity of 4,800 tons! Plants in other government buildings in Washington bring the total amount of "Freon" air conditioning to 12,000 tons!

"Freon" refrigerants are non-poisonous, non-flammable, non-explosive, practically odorless. They have been tested by the U. S. Bureau of Mines, and meet all specifications set by the Underwriters' Laboratories of Chicago. Make sure "Freon" refrigerants are included in your specifications for air conditioning.

KINETIC

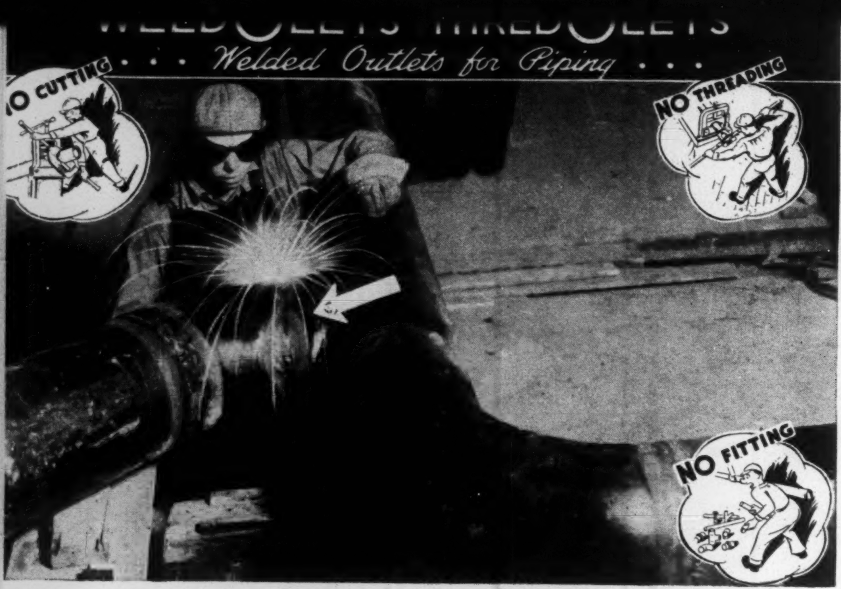
FREON

REG. U. S. PAT. OFF.

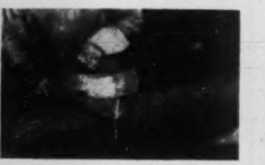
safe refrigerants

* *"Freon" is Kinetic's registered trade mark for its fluorine refrigerants.*

KINETIC CHEMICALS, INCORPORATED
TENTH & MARKET STREETS
WILMINGTON, DELAWARE

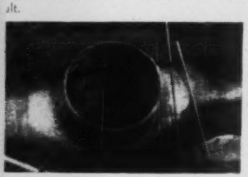


No Cutting - No Threading -
No Fitting when WeldOlets
nd ThredOlets are used

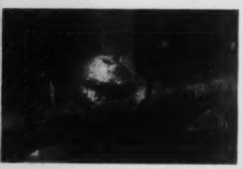


:ldOlets and ThredOlets are easily installed. ply select the position of the outlet, rub fitting over the pipe several times to remove le, mark center lines, and tack the WeldOlet ThredOlet into position.

WeldOlet or ThredOlet is then welded › place either by the electric-arc or oxy-tylene method. A junction of full pipe ngth and an outlet that is leak-proof is the ılt.



ere the outlet is 2" or larger, it is recomded that the button be removed after the ding operation. On small sizes, the fitting sed as a templet and the hole is cut in the ı pipe first. A full inspection of the inside he joint is possible by using these fittings, wing removal of all scale, welding metal,



branch line is then welded into position g a simple Vee weld. In the event that a :dOlet is used the branch pipe is threaded screwed into place. The result is a junc- of full pipe strength, absolutely leak-proof ı turbulence and friction reduced to a mum.

No Cutting—No Threading—No Fitting of the main pipe is necessary when WeldOlets and ThredOlets are used. Branch connections made with these fittings are strong, permanent and absolutely leak-proof. Preliminary layouts of the main pipe and branch are unnecessary. No templets are used.

Due to their funnel-shaped outlets, WeldOlets and ThredOlets provide free, unrestricted flow. Their heavy, external rib compensates for loss of strength in the main pipe when the hole is cut and distortion is entirely eliminated.

Available from stock with outlet sizes from ½" to 12" for all standard pipe sizes, they are equally well adapted to maintenance work and to new construction, whether indoors or out, above or below ground.

In addition to drop-forged steel in which they are stocked, WeldOlets and ThredOlets can be furnished in Wrought Iron, Toncan Iron, Brass, Monel, Everdur and other metals to meet every piping need.

The illustrations at the left show the ease with which they are installed. Try them at our expense. Sign the coupon below and attach to your company letterhead. It will bring you a sample and complete details.

The names "WeldOlets" and "ThredOlets" are Bonney trade-marks registered in the United States Patent Office. Full patent coverage has been granted in the United States and foreign countries.

BONNEY FORGE & TOOL WORKS
Forged Fittings Division
ALLENTOWN, PA.
Stocked by Leading Distributors

Bulletin WT23 tells the complete story about WeldOlets and ThredOlets. The coupon will bring your copy and a sample trial fitting. Mail it today.

Please send me a sample WeldOlet or ThredOlet and a copy of Bulletin WT23 telling all about them.
HPAC-78

Name ....

St. & No. ....

City & State ....

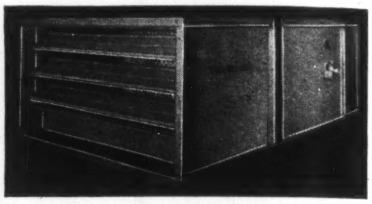
MAIL COUPON TODAY →

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 118. Add the new products and companies listed here to your Directory Section which you received in your January, 1938, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Unit Ventilators for Large Interiors

No. 1481—The new large capacity "Auditorium" unit ventilator has been designed for heating and ventilating auditoriums, gymnasiums, assembly halls, and similar large interiors where the use of smaller units is impractical. It consists of an inlet, filter, fan, heater and discharge outlet, the entire assembly being enclosed in a finished furniture steel casing. Filters may be either the dry or oil type.

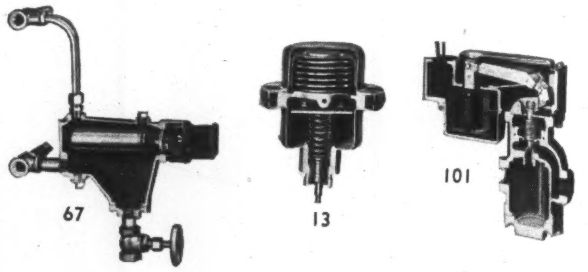


These ventilators can be installed either horizontally or vertically and can be mounted on wall or ceiling. Grilles or duct connections on either intake or discharge ends can be had.

The units are available in a wide range of sizes and complete performance data, dimension diagrams and installation details may be had.—B. F. Sturtevant Co., Damon St., Hyde Park, Boston, Mass.

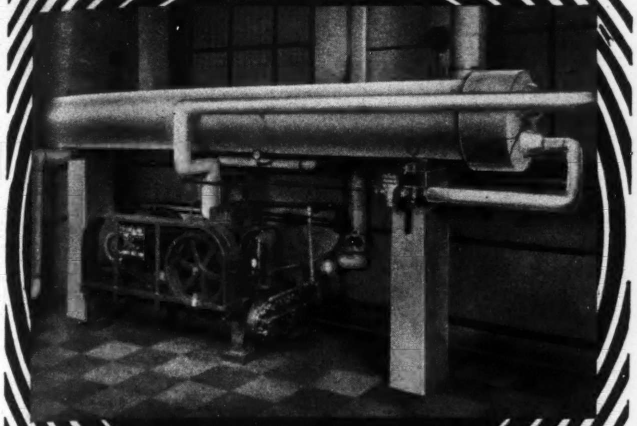
New Cut-Off, Water Valve, Pressure Control

No. 1482.—The three brand new products illustrated are a low water cut-off (No. 67), an electric water valve (No. 101) and a pressure limit control (No. 13).



The cut-off is built with two independent switches, one of which closes on a small drop in boiler water level, the other opening on a greater drop to break the oil burner or stoker circuit. The unit may be installed simply as a low water cut-off or as a combined cut-off and low water alarm, employing the switch which closes on a small drop in water level to complete an alarm circuit. Another function of this switch is to complete the circuit to the electric water valve as the two units in combination become a boiler water feeder and low water cut-off combination.

The new pressure limit control has been designed to screw into a tapping provided on the low water cut-off housing. The device consists of a bellows acted upon by boiler pressure with a plunger so designed that it will force down the float of the low water cut-off when excess pressure develops, thereby stopping the burner. Operation is thus entirely mechanical and no wiring is necessary.—McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill.



Dependability

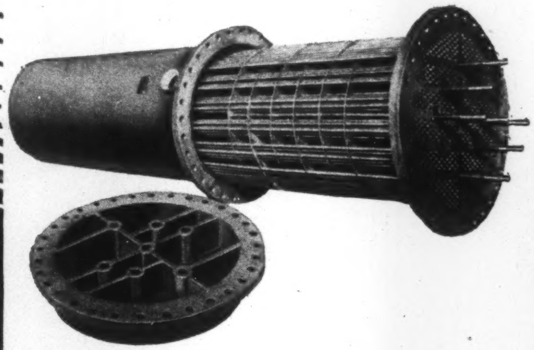
The eleven ton air-conditioning system at the Regency Club, New York, must operate without the constant supervision of an engineer.

To insure efficient cooling of the chilled water, Frigidaire chose a Patterson Freon Water Cooler for this installation. The Patterson Cooler assures:

Positive oil return.
Positive superheat.
Absolute tightness.

Our Engineers are at your service.

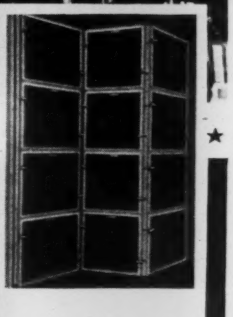
Write for Catalog.



The Patterson-Kelley Co., Inc.
107 Warren St.
East Stroudsburg, Pa.

Patterson Freon Water Coolers

Section of Grace E. Smith Cafeteria • Toledo, Ohio



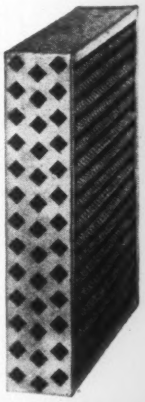
Efficient AIR-MAZE Filters keep the air free of dust and pollen.

AIR-MAZE
SUPPLIES
Clean Filtered Air
TO A FAMED TOLEDO RESTAURANT

● Nationally known as one of the finest of its kind, the Grace E. Smith Cafeteria and Restaurant is one of the most popular in Toledo. No small part of its popularity is contributed by its air-conditioning system, of which AIR-MAZE cleanable air filter panels are an important factor.

Restaurant Managers Everywhere Acclaim This Installation

Restaurant Managers from all over the country visit this restaurant to study and admire its modern food handling methods. Particularly do they manifest deep interest in, and enthusiastic approval of, the air-conditioning installation with its AIR-MAZE equipment. AIR-MAZE is the preferred filter installation for commercial buildings everywhere because of its unique scientific design, precision construction and trouble-free performance in preventing the entrance of all dust, grit and pollen. Unusual EASE OF CLEANING and NO CLOGGING are noteworthy advantages.



These Features Will Solve Your Filter Problems

1. 99.83% air cleaning efficiency.
2. Easily cleaned and charged.
3. No replacements needed.
4. Very low pressure drop.
5. Long, economical service.

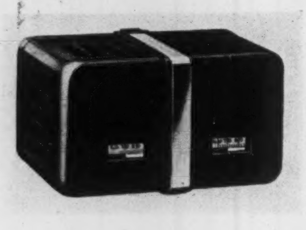
See Air-Maze in the A. S. H. & V. E. Guide Book. Write for Bulletin GPB-97.

AIR-MAZE CORPORATION
820 HURON ROAD CLEVELAND, OHIO

AIR-MAZE
CLEANABLE
AIR FILTER PANELS

Thermostat Responds Rapidly

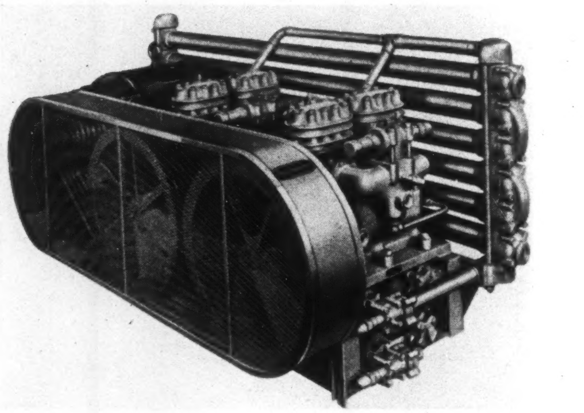
No. 1483—New "Supertherm" thermostat is novel in appearance since it is designed to be mounted on the wall with the long dimension horizontal rather than vertical. According to the manufacturer, the horizontal design is the result of extensive research directed to the problem of producing a thermostat which would respond rapidly to temperature changes. By mounting the flat bimetal member in a horizontal plane, the greatest possible surface of the temperature sensitive element is exposed to the moving air.



The thermostat is furnished in a glossy black bakelite case with polished stainless steel decorative bands; special colored bakelite can be had on order. The two horizontal windows on the front carry the adjusting scale and a liquid type thermometer. Features include a bakelite shield enclosing the contacts to protect them from dust, small permanent magnets to give snap action where required, and a small heater coil to provide heat anticipating features for use in compensated control systems and two temperature operation.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

New Water Cooled "Freon" Machines

No. 1484.—Three new water cooled "Freon-12" refrigerating machines are designed for applications that require evaporator temperatures from 0 to 50 F. While these units are entirely self-contained, the condenser may be removed for remote installation. Three phase motors are standard—20, 25 and 30 hp respectively.



Sight glasses in the crankcases provide for inspection of oil level and condition of oil. Sight glasses in the suction manifold show whether vapor or liquid is returning to the compressor; this provides an accurate means of determining the expansion valve setting and is of particular advantage on air conditioning applications where evaporator temperatures are above 32 F and no frost appears on the suction line, says the maker.

The compressor next to the motor is driven by means of v-belts pulled from the outer compressor to the motor around a section of the pulley of the inner compressor. This method of driving two compressors from one motor is advantageous in that it assures low power consumption, long belt life, a minimum of pulley overhang, and relatively low cost of belt replacement, according to the maker.—General Refrigeration Corp., Shirland Ave., Beloit, Wis.

Offers Small Solenoid Air Valve

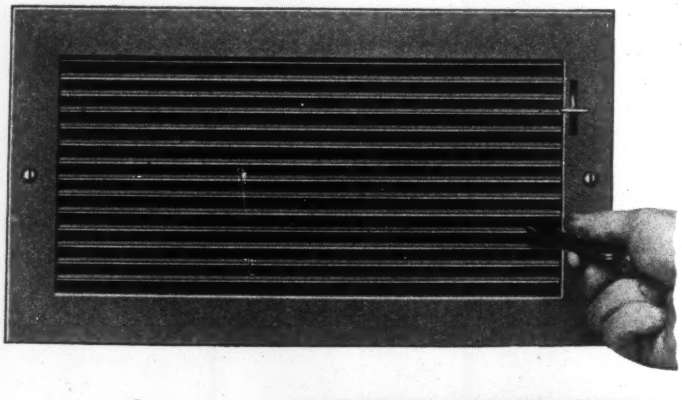
No. 1485**—A new control valve for the operation of air cylinders of diameters not over 3 in. with correspondingly short strokes in 1/8 in. I.P.T. size only and suitable for air pressure

NEW—Fin-Flex

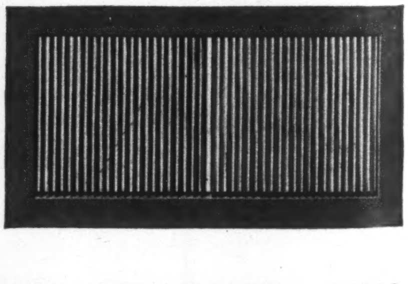
Adjustable Registers!

REGISTERS and Intakes of charming, airy, simplicity of design—abundant air capacity for modern forced air systems—yet of rugged, durable construction. Highly flexible as to direction of air—single or multiple current. Blade adjustment, as shown, is quick, easy, positive—secures air flow in any desired direction.

Fin-Flex Wall Registers and Grilles come with either vertical or horizontal fins, in all standard sizes and finishes. Fit for America's finest homes—yet priced for the "small house" market.



Ask for New Auer Air Conditioning Register Catalog.



THE AUER REGISTER COMPANY, 3608 PAYNE AVENUE, CLEVELAND, OHIO

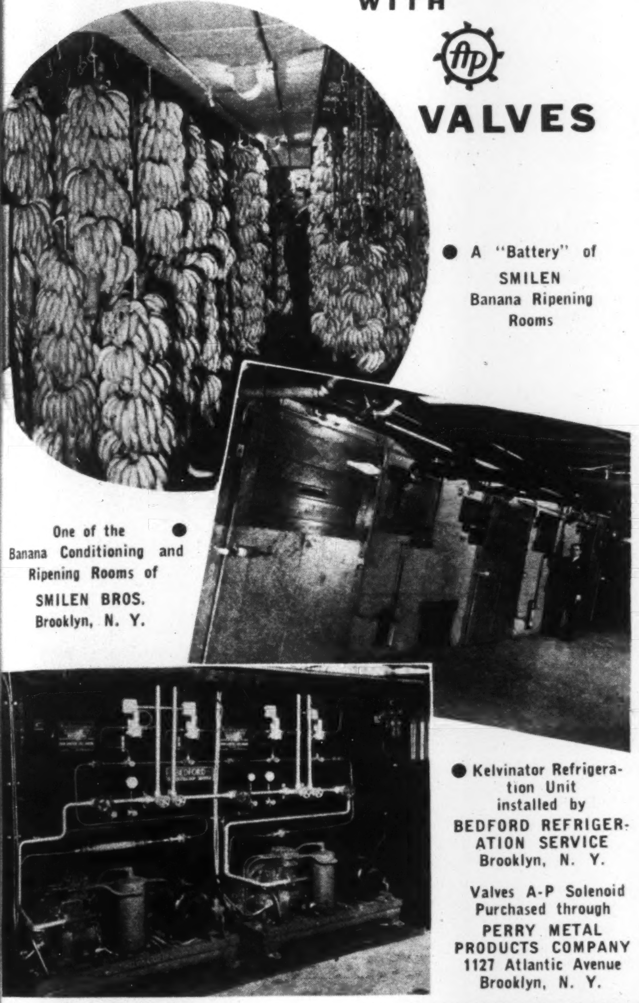
AUER DISTINCTIVE REGISTERS

& GRILLES For Air Conditioning *and* Gravity

Controlled BANANA RIPENING . . .

WITH

VALVES



● A "Battery" of SMILEN Banana Ripening Rooms

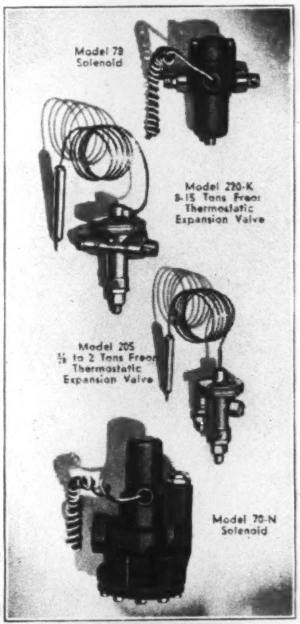
One of the Banana Conditioning and Ripening Rooms of SMILEN BROS. Brooklyn, N. Y. ●

● Kelvinator Refrigeration Unit installed by BEDFORD REFRIGERATION SERVICE Brooklyn, N. Y.

Valves A-P Solenoid Purchased through PERRY METAL PRODUCTS COMPANY 1127 Atlantic Avenue Brooklyn, N. Y.

Ripening Bananas is a test for any Air Conditioning Equipment. The need for constant and exact temperature and humidity, without fluctuations, demands much of control equipment. Here A-P Valves are doing the job to the complete satisfaction of the owner and installing and service engineers.

The ability of A-P Valves to react to small temperature changes —to assure positive opening and closing — to provide leak-proof service-free operation over a long period of use has given them a reputation that forces demand for every responsible installation.


Model 78 Solenoid
Model 220-K 8-15 Tons Freon Thermostatic Expansion Valve
Model 205 ½ to 2 Tons Freon Thermostatic Expansion Valve
Model 70-N Solenoid

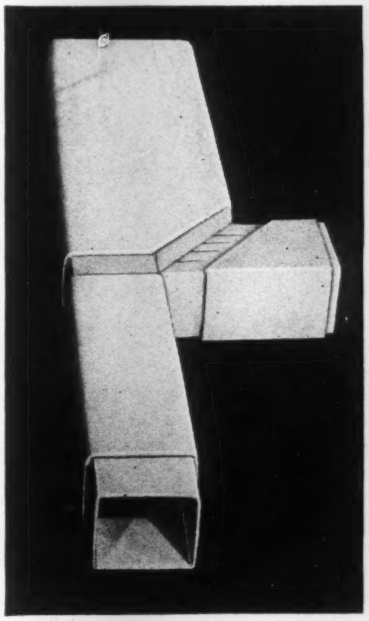
AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE WISCONSIN

DEPENDABLE
THE BYWORD FOR A-P CONTROLS

"HUSHES NOISE!"

Careyduct

THE ALL-ASBESTOS INSULATED DUCT



A SENSATIONAL development of Carey research — the All-Asbestos conduit for conveying conditioned air. Consists of a strong asbestos inner core over which an outer insulating jacket makes a close, sliding fit, providing both duct and insulation. Sizes and fittings to meet every requirement, every condition.

Cuts easily with saw —no shop work.

OUTSTANDING ADVANTAGES

1. *Sound-Deadening*—"Hushes" fan noises; reduces outside noises; eliminates the metallic "cracking" due to change in air pressure or expansion strains.
2. *Higher Velocities*—Air velocities may be increased without noise, resulting in savings in cost and space through use of smaller ducts.
3. *Fireproof-Permanent*—Made entirely of asbestos; cannot burn, rust, rot or decay.
4. *Economical*—Size for size, costs about the same as insulated metal duct. If smaller sizes, with increased velocities, are used, the cost is lowered substantially.
5. *Easily Erected*—Simple slip-joint construction makes fitting on the job easy and speedy.
6. *Assures a clean, smooth finished job.*

Write today for booklet giving complete details of the MODERN air-conditioning conduct—CAREYDUCT.

THE PHILIP CAREY COMPANY
Dependable Products Since 1873
Lockland • Cincinnati, Ohio
BRANCHES IN PRINCIPAL CITIES

TALLMADGE
Zoned Controlled
HEATING

TALLMADGE
HOUSZONE
HEATING
PATENTED

Complete zone control for smaller buildings at less cost.

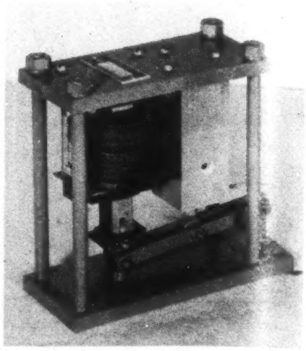
Each zone controlled by a HousZone Valve.

Can be provided with automatic control from outside temperature, wind, or sun.

Especially suitable for Housing Projects.

BETTER HEATING AT LESS COST
GIVES GREATER COMFORT
Improves Air Conditioning

WEBSTER TALLMADGE & CO.
NEW YORK CITY



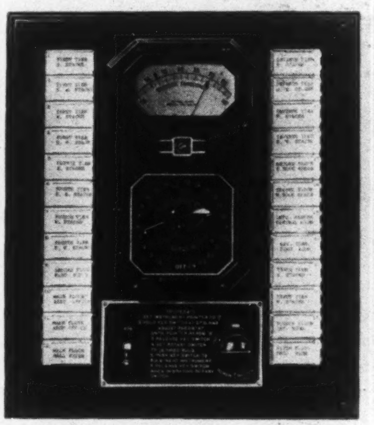
up to 200 lb operating on a solenoid with low amperage characteristics has recently been brought out. It is furnished for two-way and three-way operations. The two-way and three-way valves can be supplied normally closed or normally opened.

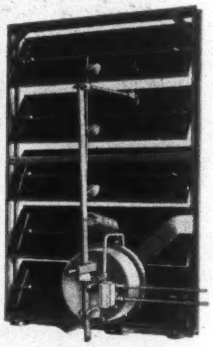
This new valve employs the same no metal to metal contact valving principle as other "Quick-As-Wink" valves manufactured by the same company. A feature is that there is only one moving part, the stainless steel plunger in the valving unit. Another feature is its freedom from leakage, the design being such that an increase in air pressure tends to tighten the air seal, the maker states.—C. B. Hunt & Son, Salem, Ohio.

Graduated Pneumatic Control, Resistance Thermometer Announced

No. 1486.—Two control developments announced last month are a "National Gradutrol" relay, and an indicating resistance thermometer.

The first mentioned is offered to eliminate hunting in pneumatic valves and dampers, and by assuring positive air pressure at all times it converts conventional pneumatic control into a system where any degree of graduation desired is possible, according to the maker. Thus, wide fluctuation caused by varying air velocities or friction in valves and dampers is prevented.





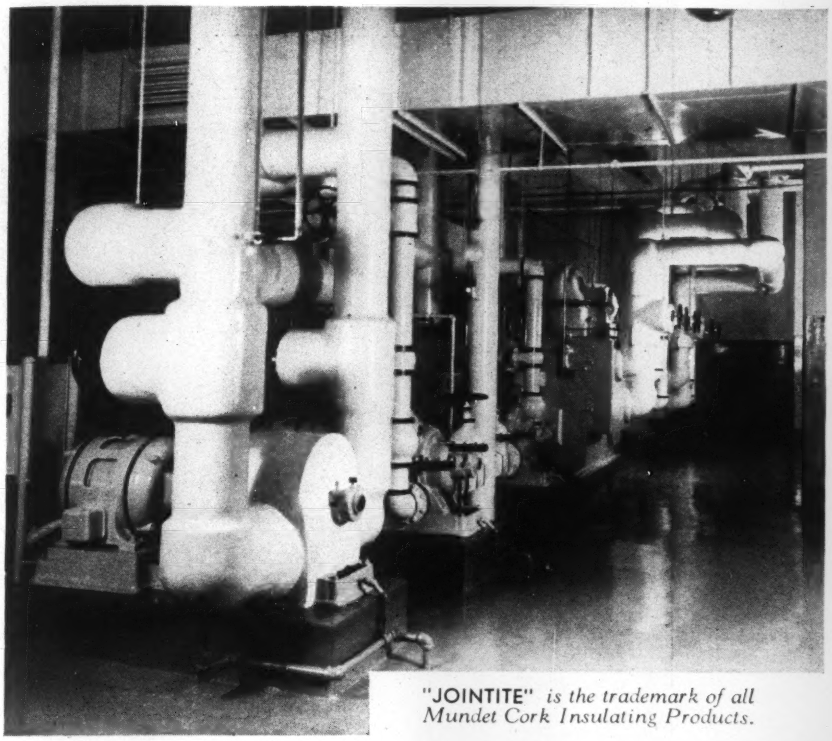
The resistance thermometer is offered for large space heating control and works from thermocouples located in any number of points desired within the building. Recording temperatures at these various points aids prevention of wasteful overheating, furnishes information for checking tenants' complaints, and helps in maintaining uniform temperatures.

According to the manufacturer, a recent check in the Chrysler building, New York City, showed that an indicating thermometer installed there resulted in a 15 per cent saving in steam last year with an average outside temperature 7 deg colder than during the previous heating season.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn.

Refrigeration Dryers Are Pressure Sealed

No. 1487.—To eliminate trouble caused by moisture in refrigerating system operation, there has been developed an exclusive vacuum drying and pressure sealing process that—says the maker—not only removes every trace of moisture from the dryer but also provides a positive means of indication that no absorption of moisture has taken place up to the point of actual installation.

MUNDET CORK INSULATION



"JOINTITE" *is the trademark of all Mundet Cork Insulating Products.*

This neat installation is in the W. C. Stripling Building, Ft. Worth, Texas. All cork insulation for the air conditioning of this building was supplied by Mundet. View shows pipe lines and pump insulated with Mundet Cork Pipe Covering (canvas finish).

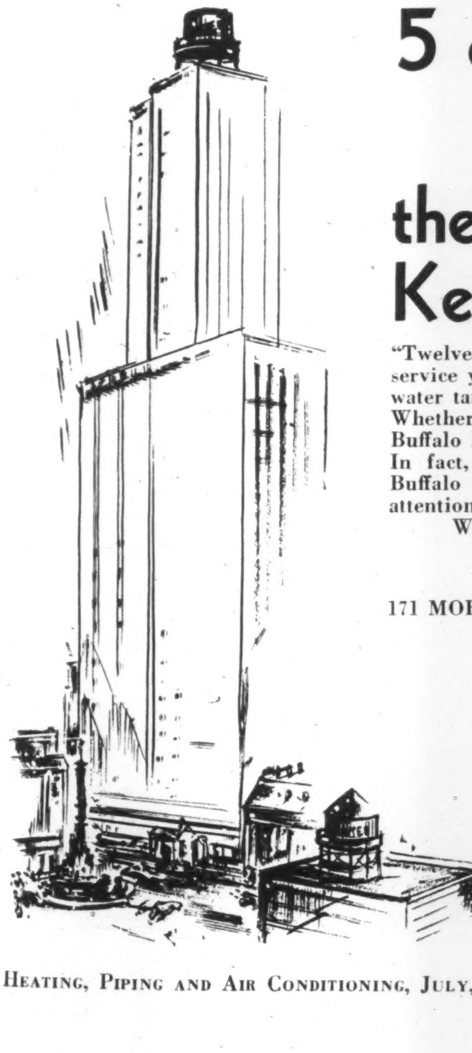
LOWERS AIR CONDITIONING COSTS . . . .

Any infiltration of warm air imposes an extra load on the air conditioning plant. For this reason, ducts and low temperature lines should be adequately protected with Mundet Cork Insulation. Mundet products comprise corkboard in correct thicknesses for air conditioning, cork lagging for insulating cylindrical surfaces, moulded cork pipe covering for low temperature lines and cork isolation for machinery vibration. Our engineering department will gladly submit specification data for your requirements.

TO AVOID VIBRATION:

Use Mundet Natural Cork Mats for fan foundations and motor mounts. These pure cork mats offer the long-term resiliency required for the economical isolation of machinery vibration. Write for descriptive material.

MUNDET CORK CORPORATION
INSULATION DIVISION
65 South 11th Street, Brooklyn, N. Y.
Offices in Principal Cities



5 or 75 Stories High

there's a "Buffalo" PUMP to Keep those Water Tanks FULL

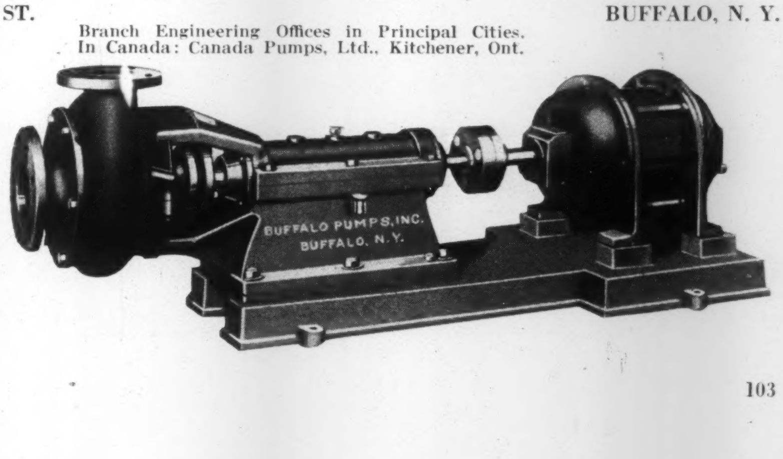
"Twelve years without a breakdown"—"19 years without a cent for repairs"—continuous service year after year at lower operating costs. This is the record of Buffalo Pumps used in water tank service.

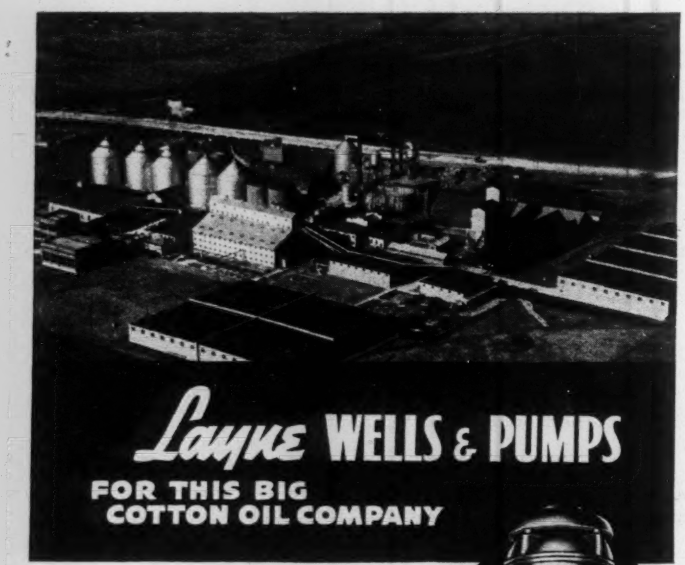
Whether your tank is but a few stories high or hundreds of feet above ground, there is a Buffalo Pump to keep the water supply at the correct level and pressure at all times.

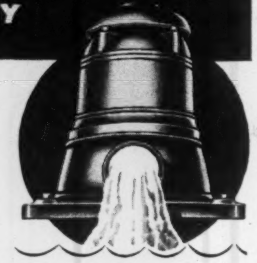
In fact, whatever your pumping requirements—water, boiler feed, special liquids, etc.—Buffalo can supply a pump to do the work efficiently, economically, and virtually free from attention.

Write today for more information on Buffalo Pumps to suit your requirements.

BUFFALO PUMPS, INC.
171 MORTIMER ST. BUFFALO, N. Y.
Branch Engineering Offices in Principal Cities.
In Canada: Canada Pumps, Ltd., Kitchener, Ont.







MORE than 12,000,000 gallons of water are supplied daily from Layne Wells and Pumps now serving Proctor & Gamble's big Buckeye Cotton Oil Mills and their Linter Pulp Purification plant of Memphis, Tenn.—and their other cotton oil mills of Greenwood and Jackson, Miss.

For years these great mills have depended exclusively on Layne Water Producing Equipment. Proof of satisfactory performance is evidenced by the recent purchase of another big Layne Well and Pump, now under construction in Memphis.

Layne Wells and Pumps are world recognized for highest efficiency in water production. Just where they are superior in design and build is told in illustrated literature that may be obtained free and without obligation by addressing LAYNE & BOWLER, INC., Dept. K, Memphis, Tenn.

AFFILIATED COMPANIES

LAYNE-ARKANSAS CO. STUTTGART, ARK.
LAYNE-ATLANTIC CO. . . . NORFOLK, VA.
LAYNE-CENTRAL CO. . . MEMPHIS, TENN.
LAYNE-NORTHERN CO., MISHAWAKA, IND.
LAYNE-LOUISIANA CO. LAKE CHARLES, LA.
LAYNE-NEW YORK CO. . NEW YORK CITY AND PITTSBURGH . . . . . . PA.
LAYNE-NORTHWEST CO. MILWAUKEE, WIS.
LAYNE-OHIO CO. . . . COLUMBUS, OHIO.
LAYNE-TEXAS CO. . . . HOUSTON AND DALLAS . . . . TEXAS.
LAYNE-WESTERN CO., KANSAS CITY, MO. CHICAGO, ILL., MINNEAPOLIS, MINN. AND OMAHA . . . . NEBRASKA.
LAYNE-BOWLER NEW ENGLAND COMPANY, BOSTON . . . . . . MASSACHUSETTS.
INTERNATIONAL WATER SUPPLY, LTD., LONDON . . . . . . ONTARIO, CANADA

LAYNE

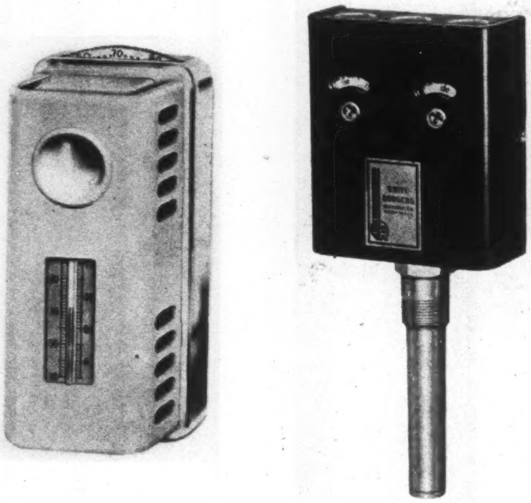
PUMPS & WELL WATER SYSTEMS

For Municipalities, Industries, Railroads, Mines and Irrigation

When the seal cap of the new dryer is removed prior to installation, there is a hissing sound due to the *escape* of dehydrated air, indicating that the dehydrant is absolutely dry.—Henry Valve Co., 1019 N. Spaulding Ave., Chicago, Ill.

New Line Voltage Room Thermostat; Hot Water Control

No. 1488**—An attractive line voltage thermostat is offered for air conditioning service in stores, restaurants and public buildings and for use with unit heaters and coolers. Available with or without thermometer and for heating or cooling service, the range on heating types is 55 to 85 F and on cooling types 65 to 95 F. The switch has a load capacity of 1½ hp, 120 or 240 volts a-c, and 30 amp 120 volt a-c, 15 amp 240 volt a-c. It is also suitable for use on low voltage.

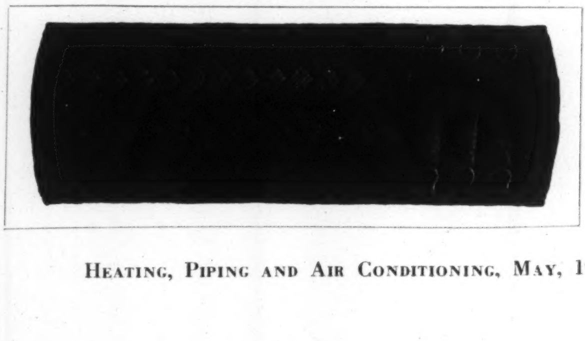


The same manufacturer has also announced a dual immersion hot water control of "hydraulic action" design, utilizing available tapping in the boiler and eliminating expense and damage to the boiler by extra drilling and tapping. With this control both the hot water supply and boiler water temperatures are maintained with a single instrument. This is accomplished with two separate switches having individual thermal elements and permitting individual setting. Each of the switches has its own adjustable differential with a range of 5 to 35 F. On summer-winter hot water systems, one switch is set to maintain domestic hot water supply at the proper temperature—it closes circuit to the automatic burner on drop in temperature. The other switch is a high limit control which opens the circuit to prevent excessive water temperature in the boiler.

Another application on hot water systems is to connect one switch in the circuit with the hot water circulator to close on temperature rise and the other is set to prevent excessive boiler temperature and opens on temperature rise.—White-Rodgers Electric Co., 1209 Cass Ave., St. Louis, Mo.

Bronze Hose of Seamless Construction

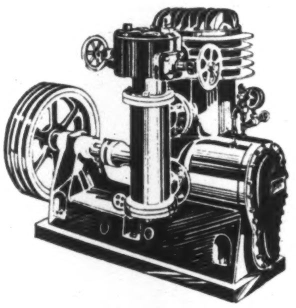
No. 1489**—Illustrated is a recently developed bronze hose of seamless construction for conveying compressed air, chemicals, steam, etc., and employed for vibration absorbers in air condition-



Sales naturally increase with FRICK Air Conditioning

As proved by the records of well-known stores equipped with Frick Refrigeration throughout the country including:

Sattler's, Inc., Buffalo
Woolf Brothers, Kansas City
J. C. Penney Co., St. Joseph
Sonnenfeld's, St. Louis
A. Harris & Co., Dallas
E. M. Kahn & Company, Dallas
The Wolff & Marx Co., San Antonio
Hochschild, Kohn & Co., Baltimore
Sears, Roebuck & Co., Washington
Murphy's 5 and 10c Stores, Washington,
Harrisburg and Pittsburgh



Frick Enclosed Freon Compressor

What are your cooling needs? Whether for air conditioning, cooling drinking water, food service, making ice or storing flowers, furs, etc., there's a Frick plant of the size and type that will make money for you.

Over 35,000 users. Ask for a survey and estimate now.

WAYNESBORO, PENNA. U.S.A.
FRICK CO.
DEPENDABLE REFRIGERATION SINCE 1882

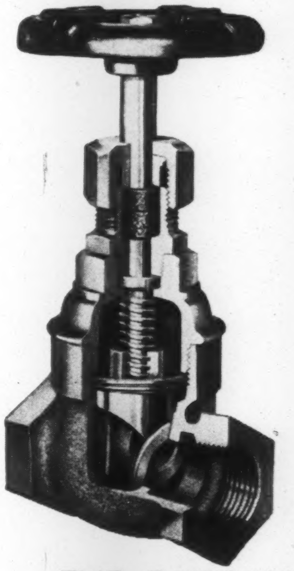
Why Fairbanks Valves Have a Longer Life

When ordinary valves reach retirement and are ready for the scrap heap, Fairbanks Renewable Valves are not even approaching "middle age." And here's why.

Fairbanks Renewable Valves can be renewed year after year without removing them from the pipe line. In fact, they last as long as the pipe line itself.

It is only human nature to discard leaky valves instead of fussing to reface them or make hard repairs. And, of course, non-renewable valves must be scrapped when worn.

But it is so much easier and quicker to put a new seat or wedge in Fairbanks Renewable Valves that workmen naturally prefer to insert new parts rather than put in a new valve.



Fairbanks Renewable Valves MUST be more accurately made to withstand the punishment of repeated renewal.

Order a few Fairbanks Valves from our distributor in your city. We know you'll use them exclusively thereafter.

Write for our Catalog No. 21.

THE FAIRBANKS COMPANY
Valves, Dart Unions, Hand Trucks and Wheelbarrows
Executive Offices:
396 Lafayette St., New York, N. Y.

Boston, Pittsburgh — Distributors in Principal Cities
Factories: Binghamton, N. Y., Rome, Ga.

Fairbanks Renewable Valves

AirMaster

GRILLES

with Interchangeable Dampers and Frames

With the new AirMaster "Build Up" Selection Method, you can make up grilles to meet the exact requirements of each individual outlet. Grilles, dampers and frames are now completely interchangeable, providing dozens of practical grille assembly combinations to cover every imaginable need. . . . Individually adjustable grille bars and damper louvres permit accurate control of throw—graduated volume control—4-way direction control.

For better, easier installations, use the AirMaster "Build Up" method of selecting grille assemblies. Write for your Free copy of the 1938 AirMaster Catalog which gives interesting suggestions on grille selections.

New 1938 Catalog gives complete details —write for your Free copy today.

WATERLOO REGISTER CO.

Waterloo, Iowa Seattle, Wash.

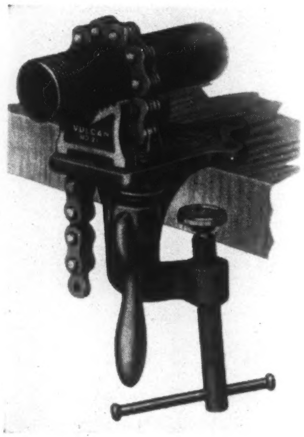
In New York City—Air Conditioning Utilities, 8 W. 40th St.

ing and refrigeration equipment, and as fuel oil connections on oil burners. It is manufactured in sizes from ⅛ in. up to and including 3 in. internal diameter.

The hose is made from specially selected seamless metal tubing and derives its flexibility from its corrugated bellows form. An armor of wire braid serves to prevent its tendency to stretch and supplies strength without affecting flexibility.

Fittings are made in two types, "Solder-On" for compressed air and cold liquids, and "Heatproof" or brazed couplings where the heat encountered is sufficient to melt solder.—Atlantic Metal Hose Co., Inc., 123 W. 64th St., New York, N. Y.

New Pipe Vise Clamps to Bench



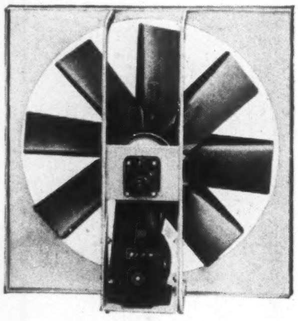
No. 1490 — New "Vulcan" clamp kit vise can be readily and firmly attached to bench, post, or other support without the use of bolts or screws, the maker states. It is easily carried, weighs only 5¾ lb and accommodates pipe from ⅛ to 2 in.

Unusual efficiency is claimed for the clamping device.

The drop forged jaws are saw tempered for file sharpening.—J. H. Williams & Co., 75 Spring St., New York, N. Y.

Ventilation Unit Offered

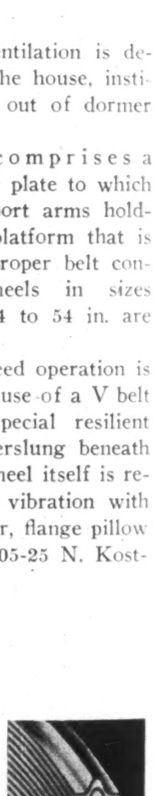
No. 1491—Improved "Coolvent" system of ventilation is designed to circulate air through every room in the house, institution or shop. Hot stagnant air is exhausted out of dormer windows or similar openings in the attic.



Construction comprises a heavy gage steel plate to which is attached support arms holding the motor platform that is adjustable for proper belt contact. Fan wheels in sizes ranging from 24 to 54 in. are available.

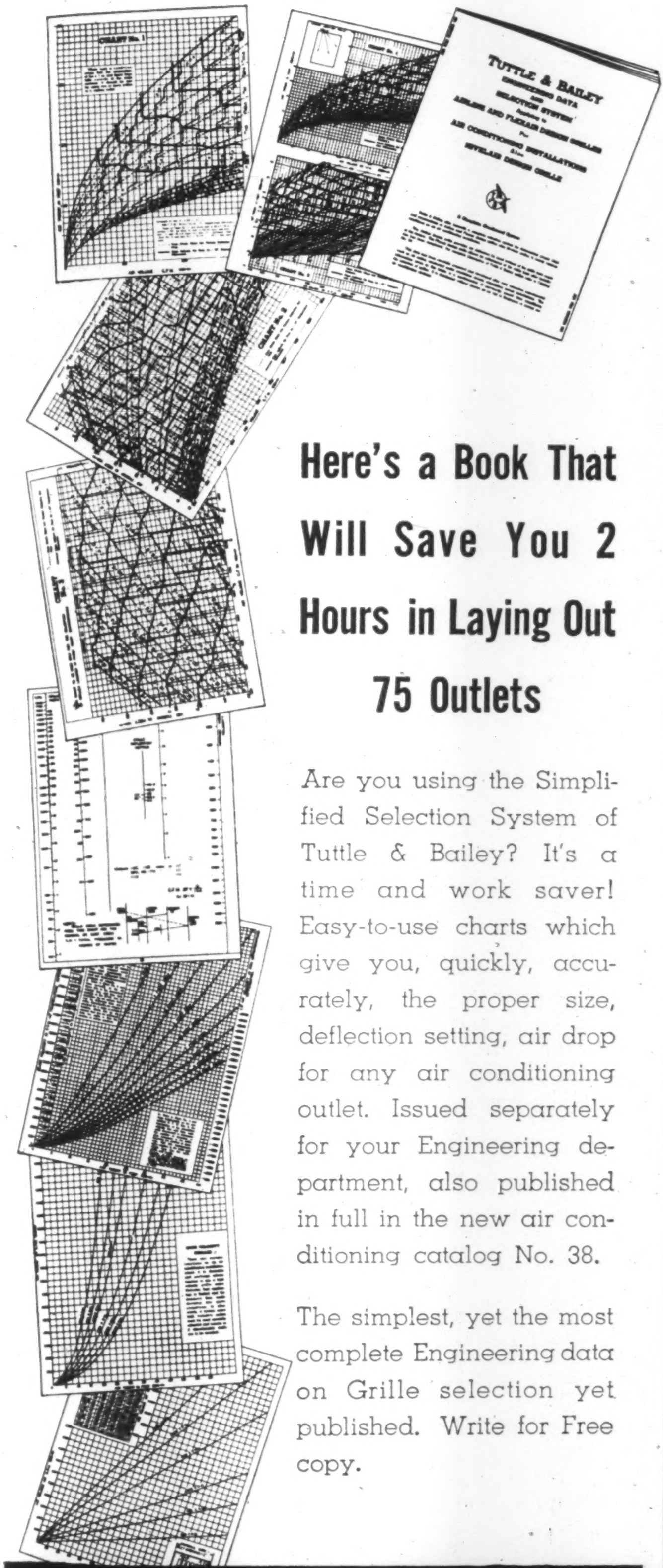
Quiet slow speed operation is secured through use of a V belt drive with a special resilient base motor underslung beneath fan. The fan wheel itself is reinforced against vibration with the shaft held in alignment by two double reservoir, flange pillow block bearings.—Autovent Fan & Blower Co., 1805-25 N. Kostner Ave., Chicago, Ill.

Spiral Wound Gasket Improved



No. 1492**—A spirally wound metal-asbestos gasket of improved construction ("Flexiwound") combines great mechanical strength, high resistance to corrosion and extreme temperatures, proper compressibility with relatively light bolting, and resilience, the maker states.

It is a general purpose gasket, recommended for use in all standard or special flanges, for boiler tube caps, handholes and manholes.—Azor Corp., Newark, N. J.



Here's a Book That Will Save You 2 Hours in Laying Out 75 Outlets

Are you using the Simplified Selection System of Tuttle & Bailey? It's a time and work saver! Easy-to-use charts which give you, quickly, accurately, the proper size, deflection setting, air drop for any air conditioning outlet. Issued separately for your Engineering department, also published in full in the new air conditioning catalog No. 38.

The simplest, yet the most complete Engineering data on Grille selection yet published. Write for Free copy.

SIMPLIFIED SELECTION SYSTEM OF TUTTLE & BAILEY

New Britain, Conn.

New York Chicago Boston
Philadelphia

CATCH HIM!

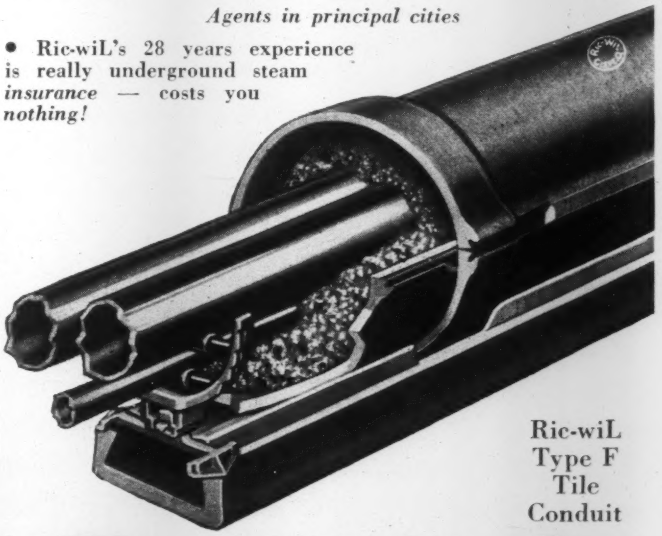
STEAM on the loose is as suicidal as permitting a valuable thoroughbred horse to roam Michigan Avenue alone through motor traffic. Runaway horse power and escaping steam mean somebody's *money lost.* Conserve steam, cut fuel costs, reduce repairs, and assure satisfactory service on the *delivery* end of steam lines—by putting your underground lines where they belong—in genuine Ric-wiL Conduit.

Ric-wiL is a pre-engineered sectional system built of vitrified tile (also furnished in Cast Iron and in Armco Iron Units). Standard Ric-wiL is insulated with patented Dry-paC waterproof asbestos (sectional pipe covering optional). Exhaustive tests prove that Ric-wiL with Dry-paC delivers over 90% efficiency *on the line.* Ric-wiL provides closed construction, efficient drainage, and opportunity for inspection during installation. Ask for latest Bulletin describing Ric-wiL complete conduit service.

The Ric-wiL Co., Union Trust Bldg., Cleveland, Ohio
New York San Francisco Chicago

Agents in principal cities

- Ric-wiL's 28 years experience is really underground steam *insurance* — costs you *nothing!*

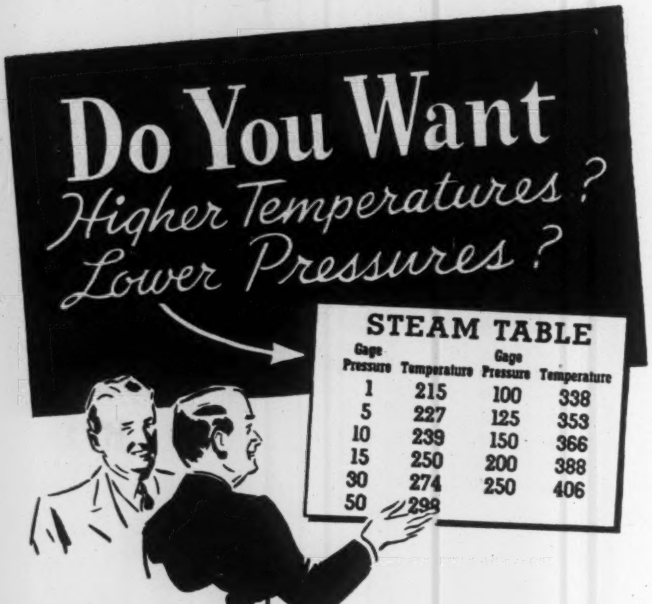


Ric-wiL
Type F
Tile
Conduit

REGISTERED IN U. S. PATENT OFFICE

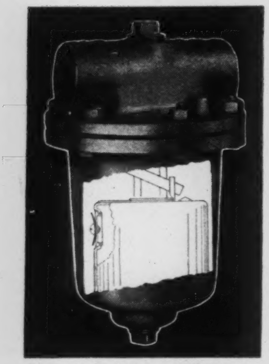
• RIC-WIL •

CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

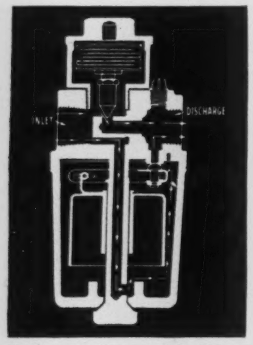

Do You Want
Higher Temperatures?
Lower Pressures?

STEAM TABLE

Gage Pressure	Temperature	Gage Pressure	Temperature
1	215	100	338
5	227	125	353
10	239	150	366
15	250	200	388
30	274	250	406
50	298		



Anderson Super-Silvertop Trap with snap action Thermal Air Eliminator. For pressures of two pounds or over.



Anderson Super-Silvertop Combination Inverted Bucket and Thermostatic Trap. For pressures from fraction of an ounce up to 50 pounds.

You can get higher temperatures on equipment without increasing the pressure—or you can maintain your present temperatures at lower pressures—if temperatures on your steam-using units do not check within 2 or 3 degrees of steam table values.

The *only* way to approach theoretical values is to maintain an air free system. These two air eliminator type Anderson Super-Silvertop traps remove all the air from the system and remove it instantly.

Find out why air elimination saves money—how steam pressures can be lowered—what air elimination can do for you—where air elimination is necessary. Send the coupon below for air elimination data. This data explains the importance of air elimination and is valuable to any steam user. Tear off the coupon and send it in now. No cost—no obligation.

THE V. D. ANDERSON CO.
1949 WEST 96th STREET • CLEVELAND, OHIO

You can send me that air elimination data. If it shows me how to save money, I'm interested.

Name.. *Company*..

Address.. *City and State*..................................

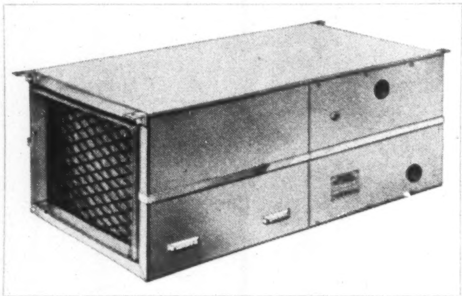
Relay for Heating and Air Conditioning Use

No. 1493.—New relay capable of handling single phase motor loads up to 1 hp or heating loads up to 1.5 kw is specifically designed for automatic heat, refrigeration, and air conditioning uses. An exclusive feature is an extra terminal for supplying power to wall clocks, indicating lamps or small sensitive relays, eliminating the necessity for a separate low voltage source.

The relay is two wire, normally open, and has large double break contacts for freedom from contact trouble.—General Controls Co., 450 E. Ohio St., Chicago, Ill.

Unit Cooler for Stores and Offices

No. 1494.—New blower type unit cooler filters, cools, dehumidifies and circulates the air and is offered particularly for use in stores and offices. It may be installed either with ducts or suspended from the ceiling without ducts; in the latter case a directional flow grille is provided for proper air distribution. Design allows for unit to be completely concealed after installation and all access to the unit and its parts is from one side of the cabinet.



The unit is made in two sizes, the smaller with a capacity of 26,700 Btu per hr sensible cooling at 85 F dry bulb entering air, and 40 lb per min water flow. The larger model has a capacity of 50,500 Btu per hr with a 60 lb per min water flow.

Units may be equipped with either cold water or direct expansion "Freon" cooling coils.—Modine Mfg. Co., 17th St., Racine, Wis.

U-Bolt Valve Has New Features

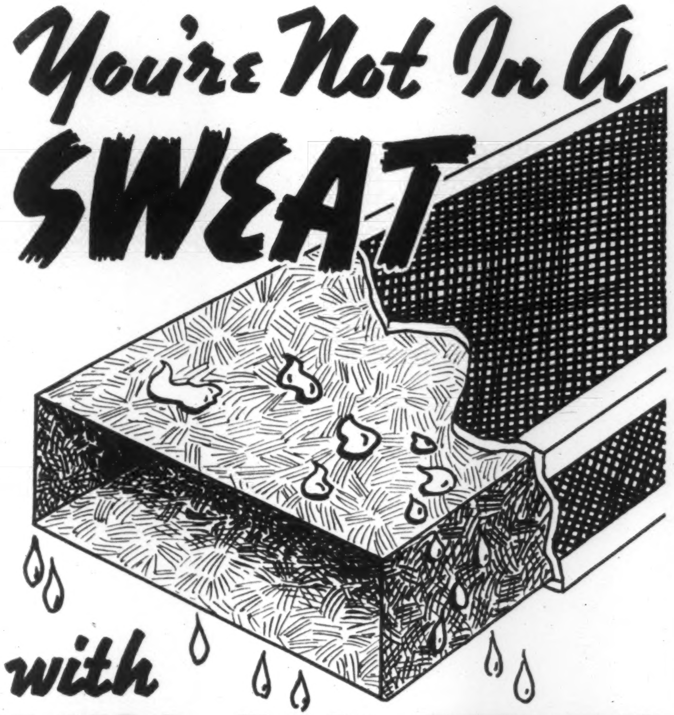
No. 1495.—One of the features of a new line of bronze mounted and all iron U-bolt gate valves is a renewable "bonnet saver bushing" which makes it unnecessary to junk the valve bonnet when operating threads are worn. By slipping a new bushing into position, the user obtains "good as new" thread engagement in the old bonnet, says the maker. Another advantage is that because this bushing can be lifted out, access may be had to the upper part of the bonnet chamber in order to clean out any deposits that form there.

Among the general advantages of this type of valve are quick and easy disassembly for inspection or repair and high resistance to springing and distortion.—Jenkins Bros., 80 White St., New York, N. Y.

Air Conditioning Units Use New Principle

No. 1496**—The recently developed "capillary" air conditioning units are described and the principle of operation is discussed in a catalog just issued by the manufacturer. With the belief that the first and major point of research to develop improved methods and apparatus must begin in the humidifier or dehumidifier portion of the air conditioning system, these units are offered as an answer to the question of how to

You're Not In A SWEAT



with DUX-SULATION

Yes sir! Ducts insulated with Dux-Sulation are "Sweatproof." . . . The possibility of condensation is checked because of the "Sweatproofing" qualities built into Dux-Sulation when it is manufactured.

Think of what this means . . . no more drippy ducts . . . no more valuable merchandise spoiled by this destructive unsanitary leaking . . . an even temperature line and a big saving in operating costs.

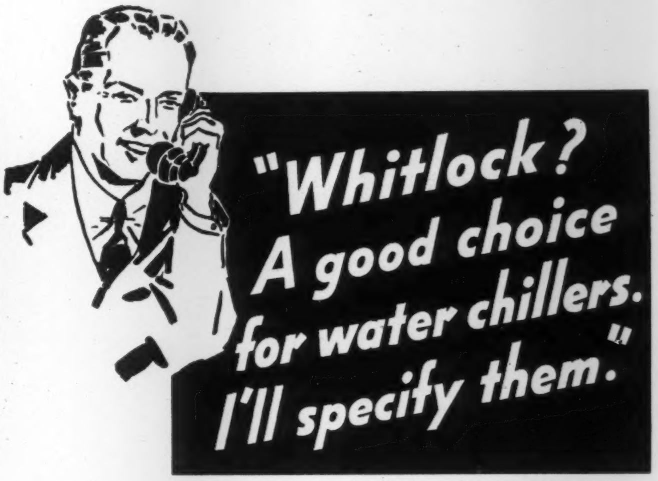
Dux-Sulation is the easiest insulation to apply on any air conditioning job. It will not chip, crack or deteriorate and makes a beautiful finished job. Requires no painting. It is asbestos protected and cannot wear out.

Investigate Dux-Sulation more fully. Send for complete Bulletin No. 386 today.

GRANT WILSON, INC.
4101 West Taylor Street Chicago, Illinois

PLANT RUBBER & ASBESTOS WORKS
537 Brannan Street San Francisco, Cal.

AIR CONDITIONING UTILITIES CO.
8 West 40th Street New York, N. Y.

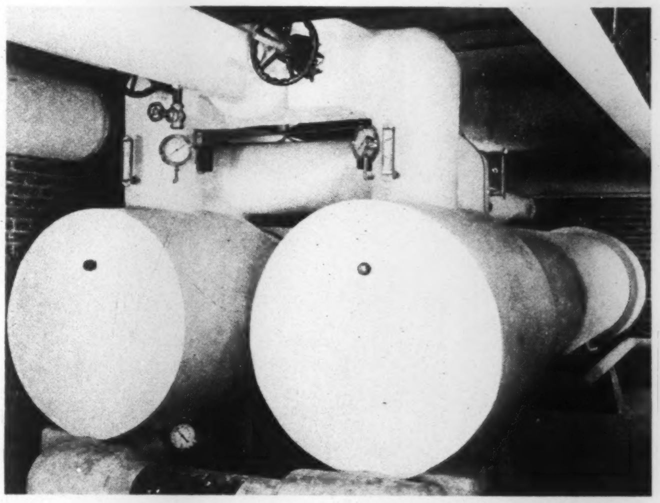

"Whitlock?
A good choice
for water chillers.
I'll specify them."

Whitlock Water Chillers, for use with Freon, Methyl Chloride, and Sulphur Dioxide are good examples of Whitlock Heat Exchangers for air conditioning service. Whitlock products for this service have the same high standards of performance and workmanship that engineers and contractors have recognized for years in Whitlock Feed Water, Instantaneous, and Storage Heaters; in Whitlock Fuel Oil Preheaters; and in Whitlock Coils.

"TECHNICALLY SPEAKING"

Whitlock Water Chillers are available in straight tube and U-tube constructions. U-tube is generally preferable; requires minimum refrigerant charge with refrigerant in tubes, water in shell but reverse operation furnished, if desired. Each chiller is submitted to careful hydrostatic and air tests, then dehydrated and sealed before shipment. No size limitations; each chiller designed and built for its particular job.

The Whitlock Water Chillers illustrated below were installed at U. S. Archives Building Extension, Washington, D. C., by the Standard Engineering Company of Washington, D. C.



For additional information, write

The Whitlock Coil Pipe Co.
44 South St., Elmwood, Hartford, Conn.

Consult the telephone directory for local address in
New York Chicago Baltimore San Francisco
Boston Detroit Richmond Cincinnati
Philadelphia Kansas City Los Angeles and other principal cities.
In Canada address Darling Bros., 120 Prince St., Montreal.

AIR CONDITIONING NOZZLES

YARWAY INVOLUTE B

Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-615.

YARNALL-WARING COMPANY
MERMAID AND ANDERSON STS.
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MONCRIEF *Air Conditioning* PIPE AND FITTINGS CATALOG

NEW

MONCRIEF AIR CONDITIONING PIPE AND FITTINGS CATALOG No 36AC THE HENRY FURNACE & FOUNDRY CLEVELAND

Send for Yours Today

You need this valuable data book in your air conditioning business. It will make estimating easier and help you lower the costs of the complete installation . . . and the Moncrief patented lock joints on wall stacks, stack heads, footpieces and trunk duct fittings make a more efficient, neater job that is easier to install.

NOW MORE COMPLETE THAN EVER

The Henry Furnace & Foundry Co.
3480 E. 49th St., Cleveland, Ohio

Write for this valuable book today

bring air and water together with the least cost and with the best results. The basic part of this type of conditioner is the cell, or cells, each of which consists of a rectangular casing filled with a mass of fine upright glass filaments held in place by a patented method of lacing. Water is sprayed over these cells and is broken up by the filaments to provide a large wetting surface; one 20 in. square cell with its 57,000 separate strands of glass provides a surface of 125 sq. ft.

The air flows through these cells and is divided into a large number of individual streams. Thus with the water and the air broken up in this manner, they are brought into intimate contact, which results in a high saturating efficiency. Other advantages are, according to the manufacturer, low resistance to air flow (which does not increase but remains constant), accuracy of control, low pumping and fan operation costs, and minimum of servicing and maintenance attention.

Applications include not only air conditioning for human comfort and in industry, but fume recovery in industrial process, and other process uses. The units may be used for humidifying and dehumidifying, depending upon the temperature of the water, and can also be used in the absorption method of dehumidification by circulating an absorbing medium instead of water. These units can also be used as a cleaning device only, and the cells are self-cleaning.—Air & Refrigeration Corp., 11 W. 42nd St., New York, N. Y.

Motor Line Completely Enclosed

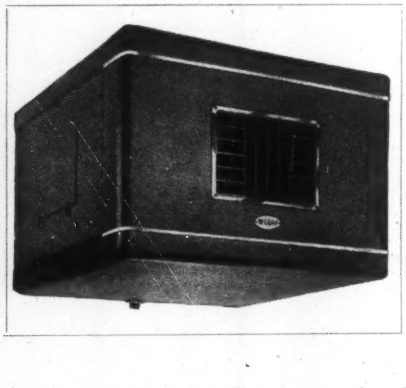
No. 1497—New "Streamcooled" motors are totally enclosed and protected against dust, dirt, splash, flame and internal damage. Offered in integral sizes, single phase, polyphase and direct current. They are cooled by means of an outer fan blowing a stream of air directed over the outside of exposed laminations. Stator construction is of the skeleton type with many exclusive design features, according to the maker.

BALDOR ELECTRIC

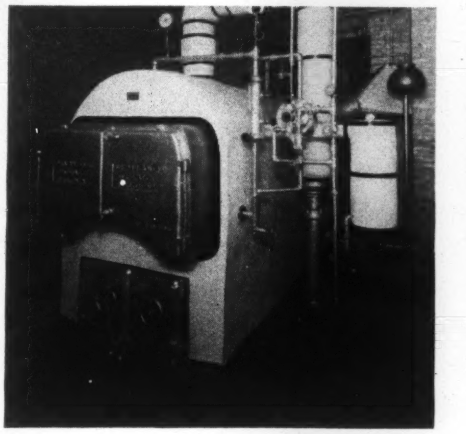
These motors are offered as the manufacturer's standard line of general purpose motors and are recommended for all applications on the basis that if the extra protection means longer life under adverse conditions, it is of great value to motors operating under ordinary conditions.—Baldor Electric Co., 4353 Duncan Ave., St. Louis, Mo.

New Line of Air Conditioners

No. 1498—New "S" series of air conditioners offer choice of recirculation of indoor air, entire intake of outside air, or a combination of both, and are particularly for use in the candy industry, factories, offices, stock rooms, and retail stores. They can be suspended from the ceiling or set upon regular store or office fixtures.



Designed with coils to use cold water, or "Freon," the units are equipped with throw away filters which can be serviced from either side. Cabinets are 18 ga automobile steel with rounded corners, finished with baked-on wrinkled enamel and decorated with stainless steel trim.



Right. It is stoker fired. The Contrapshun that does it is in a pit below floor level, which aint no fool notion at all.

Hank

Sez-It Wuz Because They Knew Our Cast Iron Boiler That They Put in a Steel

That sounds jitterbuggery doesn't it?

But it 'taint.

It's the truth.

They had a husky sized garage to heat in Lancaster, Pa. Seems as how John Skramusky, the contractor, had used a plenty of the Burnham Cast Irons. So knowing Burnhams in the knowing way he did, he sort o' figured, that they'd make a steel boiler what wuz no whit less good than their cast iron.

So he bought a steel.

Seems as how he must of felt he could depend on, depending on Burnham. Which is something you might kinder not like to forget, it's so sort o' easy to remember.

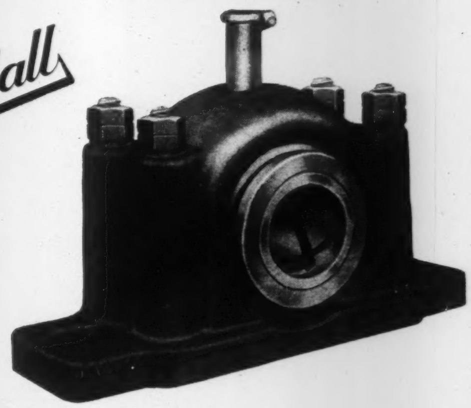
Hank Hindle

BURNHAM BOILER CORPORATION
Manufacturers of Heating Equipment Since 1873
Irvington, New York **Zanesville, Ohio**
Export Department, 50 Church Street, New York City

Burnham Boiler

THIS NAME MEANS FINE BEARINGS

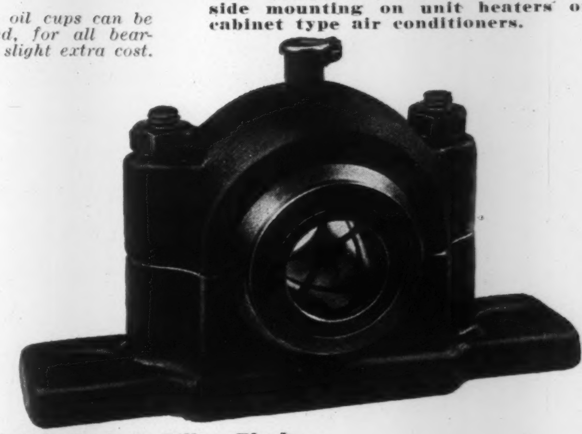
Randall



Randall Universal Pillow Block—An extremely versatile double reservoir bearing that can be mounted in any position simply by unscrewing the oil cup, turning the ball and reinserting the oil cup in a vertical position.

Randall Flange Pillow Block—Use this double reservoir bearing for side mounting on unit heaters or cabinet type air conditioners.

Large oil cups can be furnished, for all bearings, at slight extra cost.



Randall D. R. O. R. Pillow Block—This double reservoir bearing which approximates the high operating efficiency of the Universal is for use where the adjustment possible with the Universal is not required.

Write for 1938 catalog describing, in detail, the complete line of Randall Pillow Blocks.

EASTERN STOCKS

Tek Bearing Co.
177 La Fayette
New York City

PACIFIC COAST STOCKS

Utility Fan Corp.
Los Angeles, Cal.

C. W. Marwedel
San Francisco, Cal.

Randall GRAPHITE PRODUCTS CORP.
Dept. 710 609 W. Lake St., Chicago, Ill.

X
marks the spot

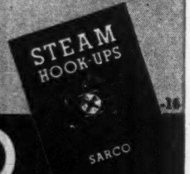
WHERE FUEL SAVINGS BEGIN

When steam traps leak—tons of coal filter through this small neck of the system every year. When they air bind, money is lost and service complaints are frequent.

Sarco Thermostatic Traps differ at this point from all others—the Sarco Bellows—never duplicated—can be tested hydrostatically up to 75 pounds on low pressure systems, and is made for service up to 200 pounds steam pressure on high pressure lines. It is powerful—yet very sensitive—and inexpensive; yet lasts for years.

There's a Sarco Trap for every kind of steam condensation removal service.

ASK FOR THIS NEW DATA BOOK
—On your business letter-head. Shows how to hook up all types of heating, air conditioning and process equipment with suitable traps and control.



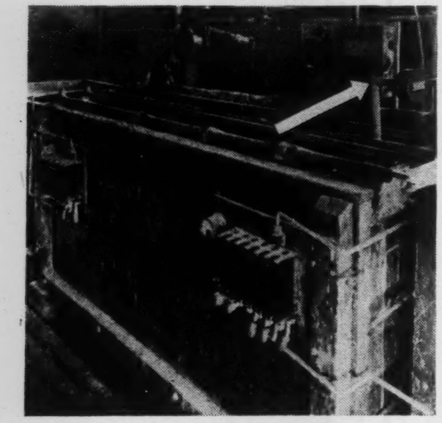
-16

COMPLETE SYSTEMS FOR HEATING AND INDUSTRY

SARCO

THERMOSTATIC, FLOAT AND BUCKET TRAPS, REGULATORS AND HEATING SPECIALTIES
SARCO COMPANY, Inc., 183 MADISON AVENUE, NEW YORK, N. Y.
SARCO CANADA LIMITED, FEDERAL BLDG., TORONTO, ONT.

BETTER electroplating with CHROMALOX electric heat



Chromalox Portable Immersion Heater, supplied in several standard forms, capacities from ½ to 6 Kw.

The uniform temperature essential to good work in a plating bath is easily maintained by the Chromalox electric immersion heater shown above, controlled by a thermostat with sensitive bulb immersed in the solution. Both heater and sensitive bulb are protected from corrosion by Monel sheaths.

The immersion heater is a standard Chromalox unit, simply dropped into the tank from the top. These units can be supplied with sheaths of any metal required to neutralize corrosive action, depending upon the character of the solution to be heated.

Where permanent installation is desired, a standard Chromalox immersion unit can be supplied for insertion through the side of the tank. Screw or flange connection prevents leakage. Tank can also be heated from outside by strip heaters clamped to the bottom.

Chromalox Book of Electric Heat, replete with data on request. Send details of your elec. heating problem.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. **Pittsburgh, Pa.**

Interiors are lined with sound deadening insulation for quiet operation.—McQuay, Inc., 1600 Broadway, N. E., Minneapolis, Minn.

Book Reviews

Gas Analysis

["Gas Analysis," by A. McCulloch, Lecturer in Fuels of the University of Manchester and the Manchester Municipal College of Technology. 1st ed. 1938. 166 pp., 5½x8½ in., clothbound. Published by H. F. & G. Witherby Ltd., 326, High Holborn, London, W. C. I., England. Price 7/6 net.]

This book was written primarily to meet the need for a small book on gas analysis suitable for students taking laboratory courses is fuel technology. The construction and manipulation of five well-known types of gas analysis apparatus in common use are described.

Following the introductory chapter sections are given on absorbents used in gas analysis; determination of hydrogen, carbon monoxide and saturated hydrocarbons by combustion; gas analysis apparatus; miscellaneous determinations; and the calorific value of gases.

The 13 page appendix gives useful tabular data.

New Text on Heating and Ventilating

["Air Conditioning—Heating and Ventilating," by J. Ralph Dalzell, Head, Architectural Engineering Department, American School, and Charles L. Hubbard, Consulting Engineer on Heating, Ventilating, Lighting and Power. 1st ed. 1938. 571 pp., 5½x8¼ in., clothbound. Published by American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Price, $4.00.]

This book is intended to be a practical treatise, written in "how to do it" style, on the principles and general applications of steam, hot water, vapor, vacuum, and forced air for heating; split systems for heating and ventilating; and air conditioning for all types of buildings.

Chapters are given on fundamentals of air conditioning, comfort standards, insulation, boilers, ventilating systems, radiators, portable radiators, direct steam heating, hot water heating, forced hot water circulation, automatic controls, vacuum systems, fans, firing equipment, air conditioning appliances, cooling methods and cooling loads, air conditioning units, air conditioning applications, and design of ducts.

A number of illustrative examples worked out in detail are included.

Motor and Generator Standards

["NEMA Motor and Generator Standards, Publication No. 38-49" superseding the previous edition of the standards, Publication No. 34-22, published in 1934. 168 pp., 8x10½ in., paper bound. Published by National Electrical Manufacturers Association, 155 E. 44th St., New York, N. Y. Price, $2.00.]

This book contains all the information in the previous edition somewhat modified and augmented. The new material includes temperature ratings of various types of enclosed motors, standardized lettering for flange mounted motors, method of measuring motor vibration, etc.

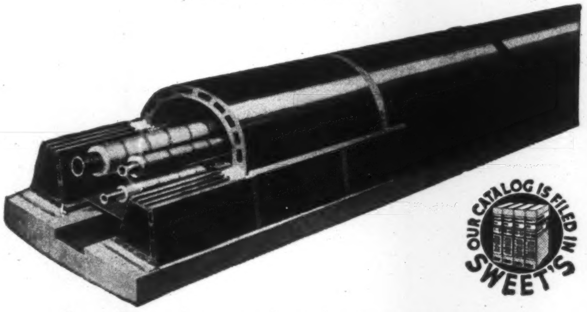
The section dealing with adjustable speed, direct current motors has been revised to give the horsepower ratings for continuous, one hour and tapered duty.

A new standard which should prove of interest is a table of maximum speeds by field weakening for constant speed d-c motors having standard horsepower and speed ratings.

THERM-O-TILE

The Conduit for Underground Steam Lines

Simplest
Strongest
Most Efficient

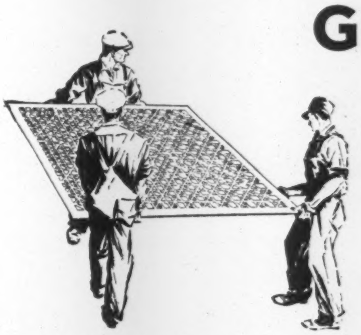

OUR CATALOG IS FILED IN SWEET'S

Complete data and estimates on request.

Sold and Installed by Johns-Manville Construction Units in all Principal Cities.

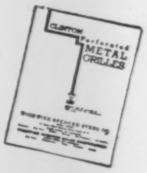
H. W. PORTER & CO., INC.
825 FRELINGHUYSEN AVE., NEWARK, N. J.

CLINTON
PERFORATED METAL
GRILLES



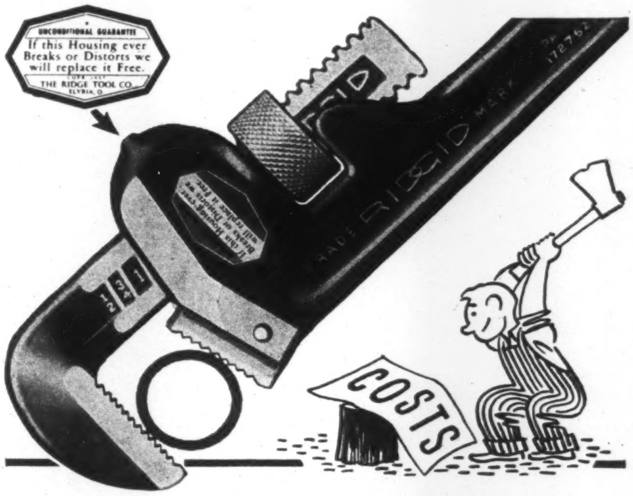
ARE IN ONE PIECE!

CLINTON GRILLES offer the widest scope of selection. They are made in various gauges of steel, brass, bronze, monel and Wissco Bronze. The extensive manufacturing facilities of Wickwire Spencer permit grilles as large as 60″ x 156″ in *one piece.*



WICKWIRE SPENCER STEEL COMPANY
41 East 42nd Street, New York
Buffalo Worcester Chicago San Francisco
Send for this new GRILLE FOLDER

WICKWIRE SPENCER perforated metals


UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free.
THE RIDGE TOOL CO.
ELYRIA, O.
RIDGID
COSTS

Cut Your Pipe Wrench Costs with this Really Guaranteed RIDGID

Millions of RIDGID users find their wrench costs have dropped because this extraordinary wrench lasts far longer.

They find their expense for wrench repairs cut fully 75% because of that RIDGID guarantee.

These savings are important these days.

The safe all-alloy RIDGID does better, easier work. Safe powerful chrome molybdenum jaws and handle. Adjusting nut *always* spins easily in all sizes, 6″ to 60″.

Cut your tool expense—order RIDGID wrenches today from your Supply House.

THE RIDGE TOOL CO., ELYRIA, OHIO

RIDGID PIPE TOOLS

Plumbers: Dependable Merchandise Makes Profits Multiply

Does the quality of your plumbing and heating supplies assure trouble-free, long-lasting installations? Remember, you save and save plenty in the long run when you install the best in materials and fixtures. For this better merchandise, always look to the responsible plumbing and heating supplier in your vicinity.

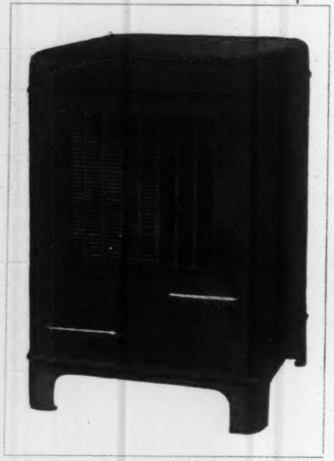
Kuhns Brothers Co.
Malleable Iron Fittings Co.

K MIF

McQUAY
COMFORT MASTER
"AIR CONDITIONER"

Fills a long existing need for a compact, efficient, and attractively designed unit adaptable to room cooling.

An economical method of securing dehumidified cool air for summer comfort in the home, small office, shop, reception room, etc.



New descriptive bulletin on Comfort Master just off press. Write for your copy today.

McQUAY INC.
1600 N. E. Broadway, Minneapolis, Minn.

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G&O FINNED RADIATION COILS for all industrial applications are available in a wide range of sizes, for high and low pressure operation.

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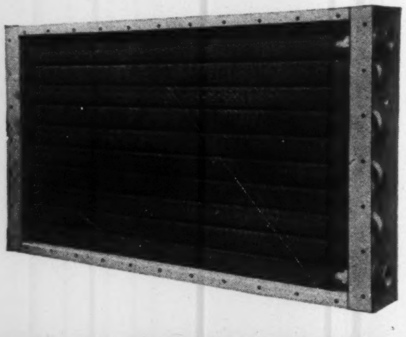


THE G&O MANUFACTURING COMPANY
New Haven, Connecticut
Pioneer Manufacturers of Square Finned Tubing in the United States

Conventions and Expositions

National Industrial Advertisers Association: Annual conference, September 21-23, Cleveland, Ohio. Committee Chairman, Stanley Knisely, Advertising Manager, Republic Steel Corp., Republic Bldg., Cleveland, Ohio.

American Welding Society: Annual meeting (in conjunction with Metals Congress Exposition), October 17-21, Detroit, Mich. Secretary, M. M. Kelly, 33 W. 39th St., New York, N. Y.

American Public Health Association: Annual meeting, October 25-28, Kansas City, Mo. Headquarters Office, 50 W. 50th St., New York, N. Y.

Power Show: National Exposition of Power and Mechanical Engineering, December 5-10, Grand Central Palace, New York, N. Y. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 118. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 2847. AIR CONDITIONING: Frick Co., Waynesboro, Pa. 4 p. issue of "The Frick System" (Vol 9, No. 12) with description of air conditioning of Glenn L. Martin aircraft factory.

No. 2848. AIR CONDITIONING AND REFRIGERATION SUPPLIES: Airo Supply Co., 2726 N. Ashland Ave., Chicago, Ill. 96 p. 1938 mid-season catalog of parts, tools and supplies for refrigeration and air conditioning, with price lists throughout, including several new items.

No. 2849. AIR CONDITIONING SERVICE: Westinghouse Electric & Mfg. Co., Mansfield, Ohio. 4 p. issue of "Business in the Air" (Vol. 3, No. 3) devoted to service, outlining a service set-up, and presenting a service contract.

No. 2850. AIR FILTERS: Air-Maze Corp., 812 Huron Rd., Cleveland, Ohio. 8 p. bulletin giving suggestions on planning air filter installations, tabular data on panel filters with frames, general technical details and other information. Simplicity of planning installations using this equipment is featured.

No. 2851. BELT: Manhattan Rubber Mfg., Div. of Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J. 4 p. bulletin (No. 6869) describing construction and applications of "Condor Whipcord" endless belt.

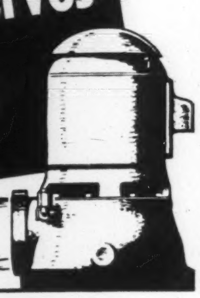
No. 2852. BOILERS: American Radiator Co., 40 W. 40th St., New York, N. Y. 16 p. bulletin on "Ideal" cast iron boilers featuring long life, low up-keep, easy installation, economy and other features.

No. 2853. CAPILLARY AIR CONDITIONERS: Air & Refrigeration Corp., 11 W. 42nd St., New York, N. Y. 24 p. booklet on capillary conditioner and its application to air conditioning with a general description, a discussion of the theory, engineering data, and a section on specific applications. Dimensions and capacities are tabulated.

No. 2854. COAL AND ASH HANDLING: Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill. 32 p. booklet (No. 1510) on solving the problem of coal and ashes handling in the power plant, with ideas and suggestions for cutting costs by means of elevating and conveying equipment, coal crushers, etc.

No. 2855. ELECTRIC UNIT HEATERS: Electric Air Heater Co., Div. of American Foundry Equipment Co., 555 Byrkit St., Mishawaka, Ind. 4 p. bulletin (No. 38-A) on "Electromode" electric unit heaters for commercial and industrial use, describing construction, operation and application and giving

A good well deserves the best pump



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BECAUSE Peerless laboratories have developed many exclusive improvements in design that result in high maintained efficiency and a trouble-free pump which is making sensational performance records.

BECAUSE Peerless uses the finest materials and precision manufacturing methods to give you a pump that will last many years longer than the average.

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For just a little difference in price, you can equip your well with a Peerless, the pump that has met the most exacting demands for over thirty years.

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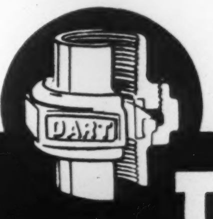

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E. M. DART MFG. CO., PROVIDENCE, R. I.

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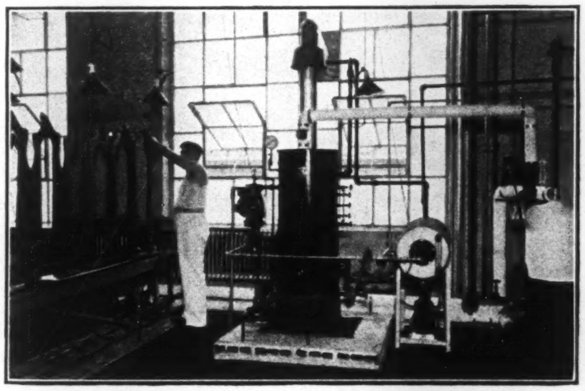

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★ ★ ★ PATERSON, NEW JERSEY

As installed—a 5 H. P. KANE AUTOMATIC STEAM BOILER with an MKO boiler feed system.

Steam generated by this boiler is used to maintain automatically a 190°F. temperature in hot water that is pumped through five twenty-four form hosiery drying tables. Steam for a 20'x16'x14' dry room is obtained also from this boiler and applied through a unit heater. Yet, despite double duty, average hourly gas consumption is but 400 cu. ft.—every bit of which is *used*, without waste.

On installations of every type the KANE is giving as efficient performances. *Free literature gives you details.*

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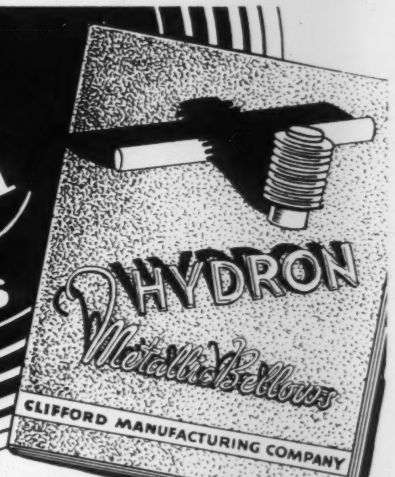

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PRODUCERS OF BELLOWS EXCLUSIVELY
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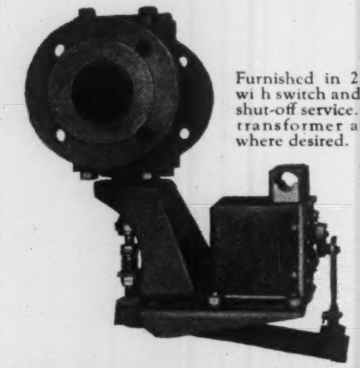

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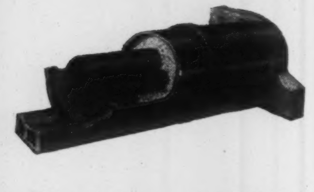

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Chattanooga Airport
Kenfield Housing Buffalo, N. Y.
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Northwestern Univ. Evanston, Ill.
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specifications. Also, similar 4 p. bulletin (No. 37-A) on "Bilt-In-Wall" and portable models.

No. 2856. FURNACES: E. K. Campbell Heating Co., 2445 Charlotte St., Kansas City, Mo. 8 p. bulletin describing large public building heavy duty furnaces, explaining principles on which design and construction are based, and why these principles make the furnace durable, gas tight, and more free from repairs.

No. 2857. HIGH PRESSURE HIGH TEMPERATURE PIPING: Pittsburgh Piping & Equipment Co., 43rd St. & A. V. R. R., Pittsburgh, Pa. Leaflet on controlled heat treating and why it is an important step in prefabrication of high pressure, high temperature piping.

No. 2858. HOT WATER HEATING: Hoffman Specialty Co., Inc., Waterbury Natl. Bank Bldg., Waterbury, Conn. 8 p. catalog on hot water controlled heat system with continuous circulation, explaining operation and giving information on adaptability to both new and old systems.

No. 2859. INSTRUMENTS: Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn. 12 p. booklet on instruments for textile mills, including temperature control, time temperature control, dye house and dryer control, and others.

No. 2860. LINE STARTERS: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Leaflet (No. W-2) on de-ion non-reversing line starters available for 3 and 7½ hp, designed for application where overall dimensions are not limited and where wiring room must be exceptionally large.

No. 2861. MOTORS: Bodine Electric Co., 2254 W. Ohio St., Chicago, Ill. 8 p. bulletin (No. 1022) illustrating and describing over 60 types of small motors equipped with speed reducers, ranging from 1/400 to 1/6 hp, with drive shaft speeds of from 1 to 300 rpm, capable of delivering torque up to 300 in.-lb.

No. 2862. MOTORS: Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Cal. 8 p. bulletin (No. 142) showing improvements in the "Klosd" motor which include patented herringbone rotor and completely enclosed motor frame.

No. 2863. NEOPRENE: E. I. duPont de Nemours & Co., Organic Chemicals Dept., Wilmington, Del. Issues of "The Neoprene Notebook" with facts and data about this material for the engineer.

No. 2864. POWER FLANGERS: Ward Machinery Co., 564 W. Washington Blvd., Chicago, Ill. 4 p. bulletin describing features of the "Almar-Bittner" power flanger, a recent development in sheet metal working machinery.

No. 2865. POWER SHEARS: Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. 18 p. bulletin (No. 70-D) on power operated circle shears, ring and circle shears, and flangers which often save heavy investment in dies for such operations as cutting fan shrouds, steel drums and containers, and in other similar uses.

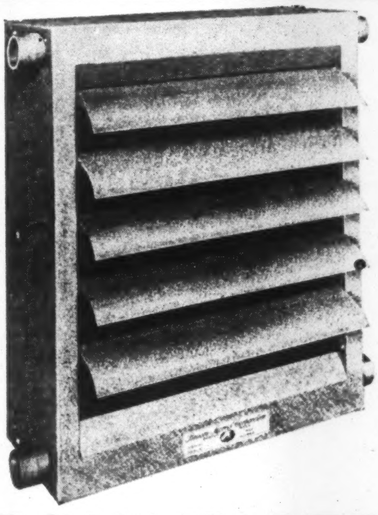
No. 2866. SHEETS: Bethlehem Steel Co., Bethlehem, Pa. Leaflet on "Beth-Cu-Loy" sheets featuring their resistance to rust and their use for ducts.

No. 2867. STEAM TRAPS: American District Steam Co., North Tonawanda, N. Y. 4 p. bulletin (No. 35-86) with details of construction and installation hook-ups for "Adsco" vertical float steam trap with or without thermostatic air bypass.

No. 2868. STOKERS: American Coal Burner Co., 155 E. Superior St., Chicago, Ill. 8 p. bulletin (No. 77) describing "Fyr-Feeder" multiple spreader stoker, describing construction and economy of its use.

No. 2869. UNIT COOLERS: Fedders Mfg. Co., Inc., 57 Tonawanda St., Buffalo, N. Y. Issue of "Fedders News" (Vol. 5, No. 5) with information on how to use unit coolers and specific examples of how to figure them.

No. 2870. UNIT VENTILATORS: B. F. Sturtevant Co., Damon St., Hyde Park, Boston, Mass. 20 p. catalog (No. 377-1) describing construction and operation of unit ventilators, and giving data on temperature regulation, capacity tables and how to use them, dimension drawings and specifications. Also 12 p. sup-



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Thoroughly modern in construction and appearance, Beacon Unit Heaters embrace a wide range of sizes, in capacities from 20,850 Btu to 318,000 Btu, for steam pressures up to 200 lbs.

Tubes, fins and headers of seamless copper without bolts or gaskets, insure greatest heat transfer. Tubes, expanded into fins without solder have orifice at inlet end which provides more efficient steam distribution. More complete details sent on request.

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TO REDUCE YOUR SERVICE AND INSTALLATION COSTS . . .

Quality equipment properly installed and correctly serviced is a winning combination you can always depend on to bring that satisfied customer's recommendation so valuable to every business. You've *always* been able to control the quality of your equipment; and NOW *you can control the quality* of your installation and service work.

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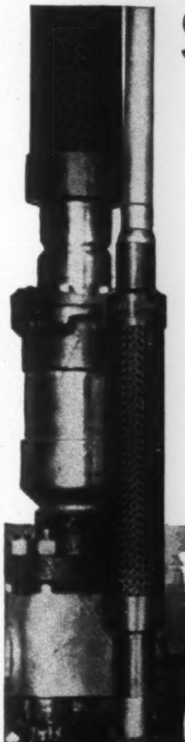

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Rex Vibra-Sorbers absorb vibration, stop noise, insure permanently quiet operation. Sweated into the compressor lines, they act as flexible couplings for speedy, trouble-free installation. All sizes available.

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Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

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1488	1489	1490	1491	1492	1493	1494
1495	1496	1497	1498			
2847	2848	2849	2850	2851	2852	2853
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2875	2876					

Name.................................. Title...............

Company ....

Address ....

City.................................. State...............

plement to this catalog on auditorium type unit ventilators for large interiors with capacity tables, dimensions, specifications and other engineering information.

No. 2871. VALVES: Homestead Valve Mfg. Co., P. O. Box H, Coraopolis, Pa. 48 p. reference book (No. 38) featuring a more complete line of boiler blow-off valves, several new lines of lift plug valves, giving complete dimensions, tables and facts about construction and application. Suggested metal for special service conditions and suggested uses for valves are included.

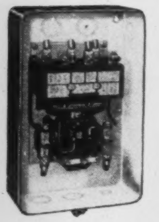
No. 2872. VALVES, FITTINGS, PIPING AND TOOLS: Walworth Co., 60 E. 42nd St., New York, N. Y. 602 p. catalog covering the manufacturer's complete line of valves, fittings, pipe and tools, with many features to render it of increased usefulness to engineers, contractors, plant superintendents, purchasing agents, plumbers and others, and with a special index to permit quick reference. Among the new sections not contained in previous catalogs are the marine section; the lubricated plug valve section, with particular reference to fluids, gases and the like, with recommendations as to the types of lubricants best suited to them; the "Walseal" section; the "Hi-Test" cast iron pipe section; the fabricated pipe section, containing information of value in laying out piping jobs; the piping design and engineering data section, including many original charts helpful in figuring the sizes and types of piping necessary for particular operating conditions; and the soil pipe section.

No. 2873. VIBRATION CONTROL: Korfund Co., 48-15 32nd Pl., Long Island City, N. Y. 16 p. reprint of paper on "Theory of Vibration Control" presented by S. Rosenzweig before the American Society of Mechanical Engineers at the Dallas meeting. The treatise covers the subject of machinery vibration transmission and its elimination both from a theoretical and a practical standpoint.

No. 2874. WELDED PIPING OUTLETS: Bonney Forge & Tool Works, Tilghman St. & Meadow St., Allentown, Pa. 4 p. bulletin on "WeldOlets" and "ThredOlets" including the new socket end "WeldOlets," describing these drop forged fittings for making branch pipe outlets and their advantages.

No. 2875. WELDING ELECTRODES: Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis. 28 p. bulletin (No. R-5) on "Smootharc" welding electrodes, which has been designed to be a valuable reference book for welder users.

No. 2876. ZONED HEATING: Webster Tallmadge & Co., 225-255 N. 18th St., East Orange, N. J. Blue print sheet of engineering information on "HousZone" heating system showing diagrams of two pipe steam system for four zones, two pipe steam system for one zone, several wiring diagrams for different control arrangements, and many other notes and data of an engineering nature.



BULLETIN 709 AUTOMATIC STARTER for squirrel-cage motors

This compact across-the-line solenoid starter provides remote control and no-voltage protection. Its silver alloy contacts require no maintenance. Available in ratings to 15 hp, 110 volts; 30 hp, 220 volts; 50 hp, 440-550 volts. Write for Bulletin 709.

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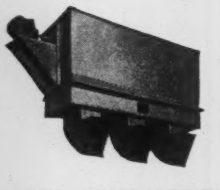

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A Full Range Of Capacities In All Types

THE AIRVECTOR—a newly redesigned propeller fan type unit heater backed by 30 years of manufacturing experience.

THE AIRHEATER—Large capacity blower type unit heaters for floor, wall and ceiling mounting.

THE AIRBLANKET—a revolutionary type of heating unit which holds the heat in the working zone through the use of an overriding cold air blanket. Write for your copy of "The Final Chapter" describing the AIRBLANKET in detail.

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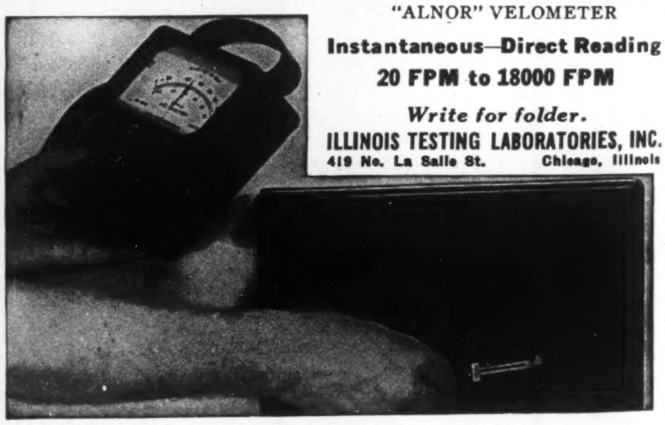

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Instantaneous—Direct Reading
20 FPM to 18000 FPM

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EVERDUR

the nation's choice for non-rust water heaters of all types

OWNERS AND TENANTS everywhere want hot water that is free of red heater rust. And at the same time they want heating equipment that frees them from maintenance expense due to rust damage. So throughout the country—in department stores, office buildings, textile mills, laundries, hospitals and other institutions—rustable metal for heater shells is giving way to strong, non-rust Everdur Metal. As a result of this trend toward more prudent investment, more Everdur tanks and heaters are being installed per week than were built in the entire year 1929.

Everdur Copper-Silicon Alloy assures economical, long-lasting heater tank service. It is exceptionally strong, rustless as copper, readily weldable and moderate in cost. For all types of industrial, commercial and residential installations, Everdur storage heaters are obtainable from leading equipment manufacturers.

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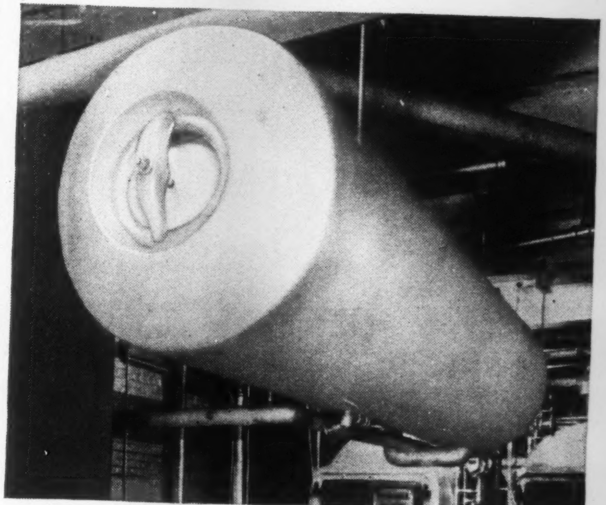
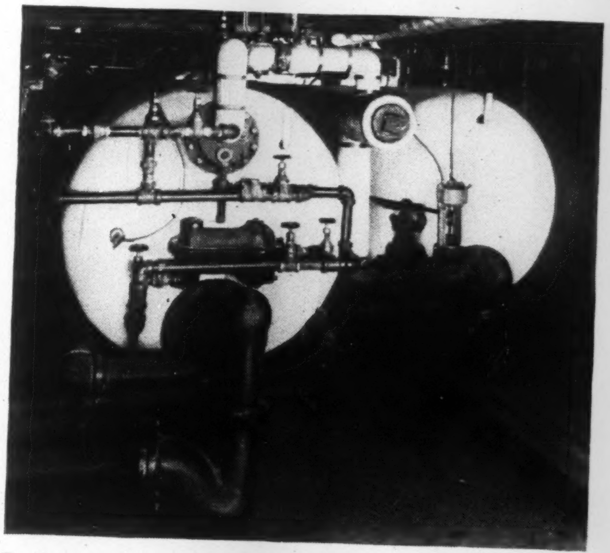


PATTERSON-KELLEY Solid Everdur Heater, 36″ x 144″, recently installed in the Commissary Department of Bickford's Restaurant, New York. Built by PATTERSON-KELLEY CO., INC., East Stroudsburg, Pa. Designed for 100 lbs. working pressure; heating capacity 1300 g.p.h.



Boiler room in Hearns Department Store, New York, showing a PATTERSON-KELLEY Solid Everdur Storage Heater, 48″ x 144″, with a heating capacity of 1200 g.p.h. In foreground is a Special Patterson Solid Everdur Heat Exchanger, 48″ x 144″, with 105 sq. ft. of Copper Tubing in the cooling section, plus an additional live steam auxiliary heating element. Not shown is another Patterson Everdur Heat Exchanger, 30″ x 72″, with 27 sq. ft. of cooling surface. *Consulting Engineer:* Stewart A. Jellett, Philadelphia, Pa. *Heating Contractor:* Jarcho Bros., Inc., New York.

Everdur TANK METAL ANACONDA from mine to consumer

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut
In Canada: Anaconda American Brass Ltd., New Toronto, Ont. • Subsidiary of Anaconda Copper Mining Co.

"EVERDUR" is a trade-mark of The American Brass Company, registered in the United States Patent Office.

Plenty of
Rust-Free Hot Water
for
Hearns Department Store
and Bickford's Restaurant

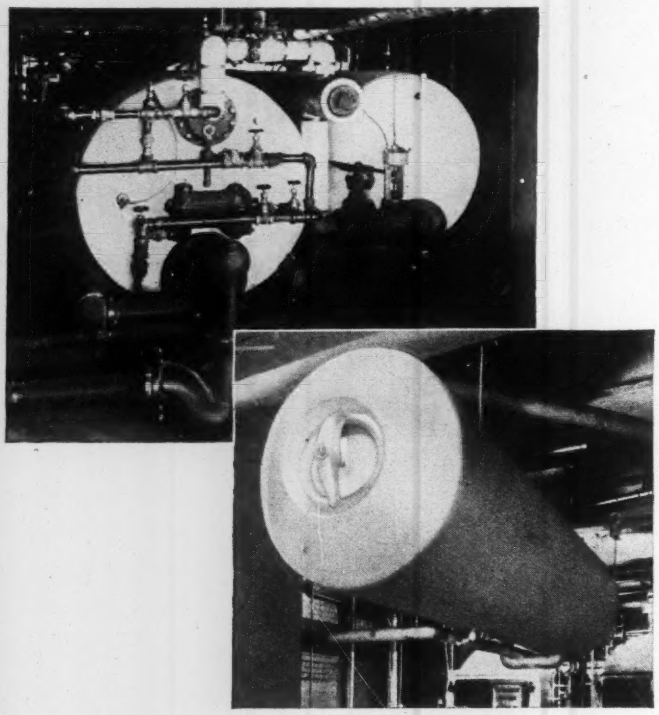


Illustration shows Patterson Everdur Hot Water Heaters in Hearns Department Store and Bickford's Restaurant, both in New York City.

Patterson Everdur Heaters cannot rust or cause red water because the shell is nearly all copper, scientifically alloyed with silicon and other elements to provide the tensile strength of steel. The heads, nozzle, tubes and all other parts which come in contact with water are made of Everdur or copper.

You take no chances when you install Patterson Heaters. They are guaranteed by a 58-year-old concern to furnish all the hot water required, as hot as required, and as quickly as required.

Send for our catalog.

THE PATTERSON-KELLEY CO., INC.
107 Warren St., East Stroudsburg, Pa.

Patterson
EVERDUR
Hot Water Heaters

Booklets, Reports and Papers

Pressure Losses in Air Ducts Due to Changes in Cross Section

Owing to structural peculiarities and limitations, or to changes in the quantity of air being carried, changes in the cross sectional area of ducts conveying air frequently become necessary. In designing duct systems data on the pressure losses resulting from such changes are necessary in order to evaluate the total resistance to the flow, a reasonably accurate estimation of which is required for the proper selection of fans and motors.

The investigation described in Bulletin No. 300, "Pressure Losses Resulting from Changes in Cross Sectional Area in Air Ducts," by Alonzo P. Kratz and Julian R. Fellows, just issued by the Engineering Experiment Station of the University of Illinois, had for its object the determination of the losses in total head, or total pressure, otherwise called "shock loss," resulting from abrupt changes in the cross sectional area of an air stream, or occurring in various transition sections connecting ducts of different diameters.

Among the conclusions reached as a result of this investigation are the following:

(1) The shock losses in abrupt contractions are much smaller than those caused by abrupt expansions.

(2) The shock losses in diverging sections are dependent on the angle included between the sides of the section, the smaller losses occurring with the smaller angles; and the loss with an included diverging angle greater than 60 deg is as great as that occurring with an abrupt expansion.

(3) The shock losses in converging sections are also dependent on the angle included between the sides of the section, the smaller losses occurring with the smaller angles; and the loss with an included converging angle of 60 deg is less than that in an abrupt contraction.

Until December 15, or until the supply available for free distribution is exhausted, copies of this bulletin may be obtained without charge upon application to the Engineering Experiment Station, Urbana, Ill.

Standards for Steam Jet Ejectors and Vacuum Cooling

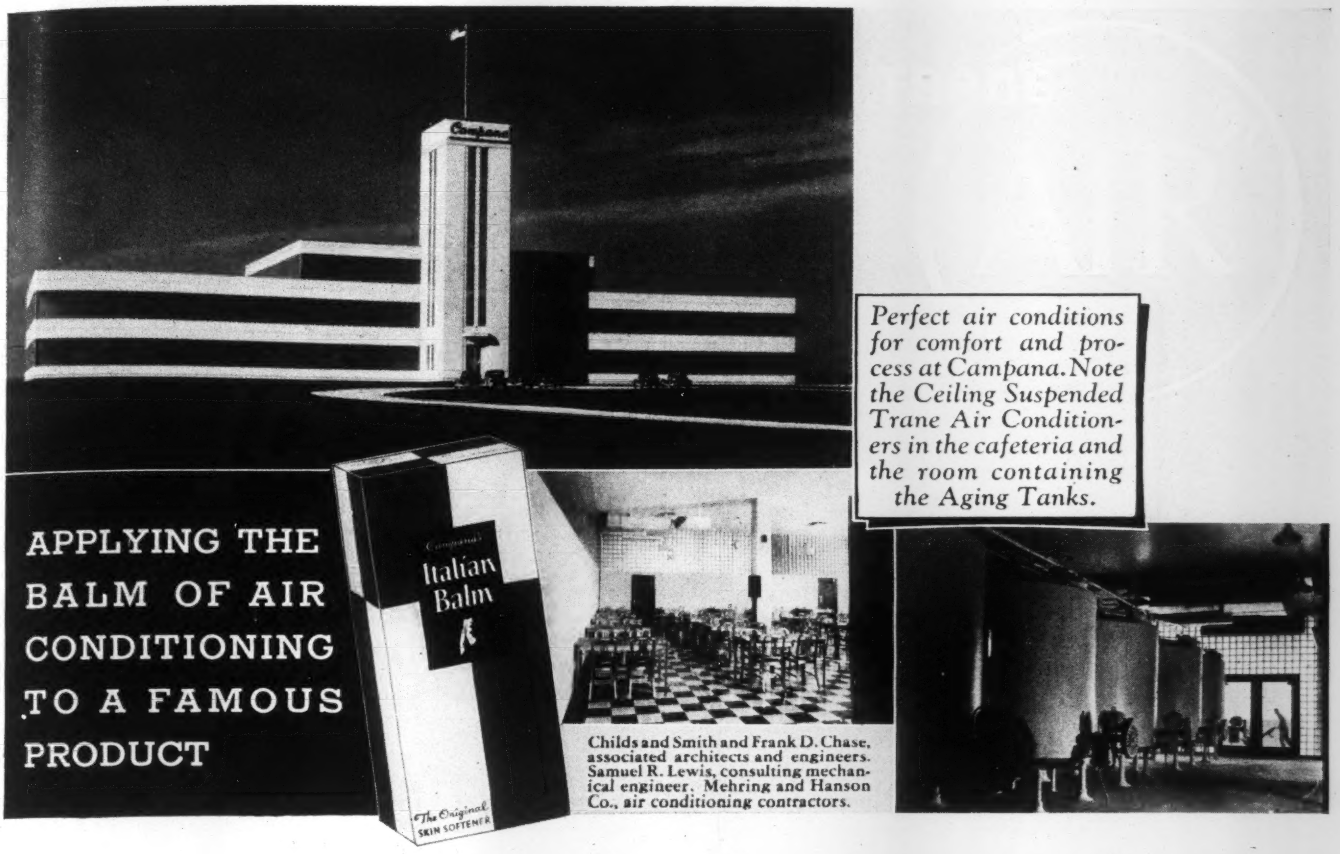
The Heat Exchange Institute, 90 West St., New York, N. Y., has recently published the steam jet ejector and vacuum cooling section of its standards consisting of three parts: Steam jet ejectors; test code; and steam jet vacuum refrigeration equipment.

The first part covers nomenclature, operating principles, types of assemblies, capacity and standard accessories and materials of construction. The test code supplies standard methods for testing steam jet ejectors, including standard air nozzle orifices, arrangements of apparatus for conducting various tests, steam flow and air and water vapor mixture curves. The third part covers nomenclature, definitions, performance, construction, standard units and special types.

Copies of this 40 page, 8½ by 11 in., paper bound publication can be obtained from the secretary of the institute, C. H. Rohrbach, for $1.00.

Weather and Health

Dr. Clarence A. Mills, professor of experimental medicine, University of Cincinnati, writes on weather and health in the April, 1938, *Bulletin* of the American Meteorological Society,



APPLYING THE BALM OF AIR CONDITIONING TO A FAMOUS PRODUCT

Perfect air conditions for comfort and process at Campana. Note the Ceiling Suspended Trane Air Conditioners in the cafeteria and the room containing the Aging Tanks.

Childs and Smith and Frank D. Chase, associated architects and engineers. Samuel R. Lewis, consulting mechanical engineer. Mehring and Hanson Co., air conditioning contractors.

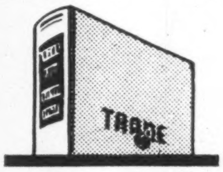
IN the beautiful new plant of the Campana Company at Batavia, Illinois, employee comfort hits a new high and Campana's product, Italian Balm, is accurately manufactured under proper air conditions.

Here every phase of true year 'round air conditioning is served by 21 Large Trane Suspended Type Air Conditioning Units and over 50 Trane De Luxe Floor Type Air Conditioners which take care of spaces such as lobbies, display rooms, halls and small offices.

In this one building are incorporated:

1. General office space.
2. A Processing Room.
3. A Special Deal Machine Line Room.
4. A Laboratory.
5. A Cafeteria.
6. A Warehouse.

Each has special requirements. Each is correctly served by Trane Equipment. And the completely mechanized factory equipment is interlocked with the air conditioning system. A truly unified design and installation.



Have you ordered your Trane Air Conditioning Manual yet? Press and public agree that this 325 page volume is a great contribution to the air conditioning industry. Price $5.00, with order, postpaid in the U.S.

THE Trane Suspended Air Conditioner, illustrated above, is only one of many units produced by Trane for commercial, process and comfort work. Applications vary from the feather-weight 30-pound heating system for the famed China Clipper, to the huge air conditioning network built to order for Chicago's great Palmer House.

• • •

Campana's interesting air conditioning system is described in Volume II Number 1 of WEATHER MAGIC, Trane's newsy house organ. Copies gladly sent on request.

• • •

The complete Trane Heating, Cooling and Air Conditioning Line is merchandised for installation by the local contractor, based upon specifications by the architect and consulting engineer. Cooperation through 70 branch offices in U.S.A., or write direct to the main office at 2004 Cameron Avenue, La Crosse, Wisconsin.

The Symbol (AIR^n) is used exclusively by Trane to Signify the Nth degree of excellence in Heating, Cooling and Air Conditioning Equipment.

The HAND of TRANE
HEATING
COOLING
CLEANING
VENTILATING
HUMIDIFYING
DEHUMIDIFYING

TRANE

THE TRANE COMPANY AIR^n LA CROSSE, WISCONSIN

Also TRANE COMPANY OF CANADA LTD., TORONTO, ONTARIO

Unit Heaters - Specialties - Convectors - Climate Changers - Cooling Coils - Unit Coolers - Blast Coils - Unit Ventilators

Vol. 19, No. 4. Dr. Mills is well known to air conditioning engineers for his papers on effect of air conditioning on human welfare and his discussion of control of body heat loss through radiant means, presented at the 1938 annual meeting of the A.S.H.V.E. and published in the *Journal Section* of HEATING, PIPING AND AIR CONDITIONING.

According to Dr. Mills, climatic and weather domination over human existence is exerted through two rather distinct and separate factors. Mean temperature level, by its effects on the ease with which the body may dissipate its waste heat, possesses a marked influence over heat and energy production in the body, growth rate and development, fertility, and resistance to infection. The basic factors that determine the level of existence are thus directly dominated by external temperature levels and the ease of body heat loss.

Storms, with their sudden weather changes, affect man in quite different ways. The body stress they engender seems closely related to many of man's important sicknesses, particularly those of the respiratory tract. Functions in the nervous system also seem much affected by these atmospheric changes, probably more by pressure changes than by those of temperature. Effects of storminess are most evident on a seasonal basis.

The irregularly recurring changes in temperature level and storminess that take place through the decades also produce definite changes in human health and energy. These show clearly in sickness and death rates and in man's chief expression of energy, his business activity.

Water Supply for Air Conditioning

The papers on water and air conditioning presented at the New Orleans convention of the American Water Works Association have been published in the June *Journal* of the A.W.W.A., Vol. 30, No. 6. Included are the paper by O. C. Holleran on increases in water demand and their causes (especially with relation to water use for air conditioning) which is based on the recent study made by the Bureau of Foreign and Domestic Commerce in all of the 486 U. S. cities of more than 20,000 population; the round table discussion on meeting demands created by air conditioning which was participated in by several city engineers and water department superintendents; and a report by Loran D. Gayton, city engineer, on air conditioning in the city of Chicago and investigations made during 1937.

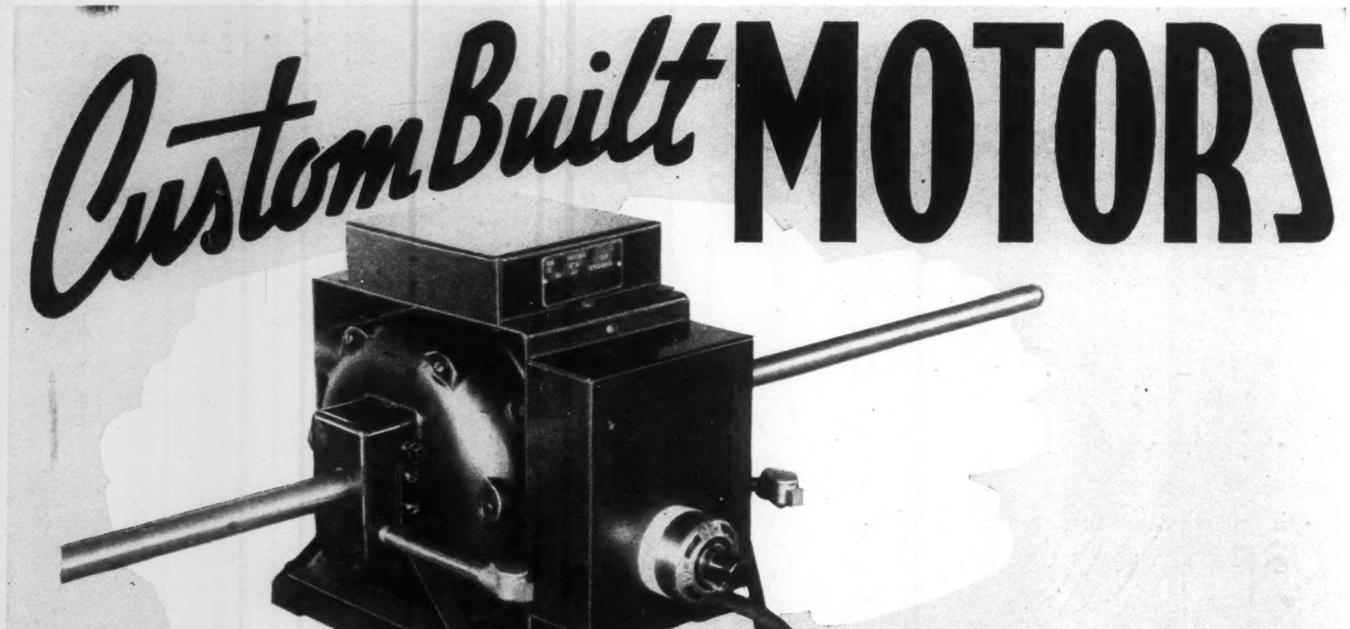
Book Reviews

Welding Society Publishes Handbook

["Welding Handbook" prepared by 90 authors and 250 reviewers under the direction of the A.W.S. handbook editorial committee of which D. S. Jacobus was chairman. 1st ed. 1938. 1211 + xvii pp., 6 x 9 in., imitation leather binding. Published by American Welding Society, 33 W. 39th St., New York, N. Y. Price to members, $5.00; non-members in U.S.A., $6.00; elsewhere, $6.50.]

The work of many authorities is represented in this new book which goes into practically every phase of the subject of welding. There are six major sections which are, in turn, divided into over 60 chapters. The major sections are (1) a general introductory discussion of welding processes and definitions of terms and welding symbols, and instructions for their use; (2) a section on the various welding processes, including cutting, soldering, surfacing or facing, metal spraying, flame hardening and stress relieving; (3) a section on materials and metallurgy, which includes data on various alloys; (4) a section on testing; (5) one on welding applications; and (6) a concluding section on critical digest of welding literature prepared by the Society's welding research committee.

Included in the applications section are chapters on the arc


Custom Built MOTORS
For Your Specific Needs
The HOLTZER-CABOT Electric Co.
CHICAGO·NEW YORK BOSTON MASS. PHILADELPHIA

welding of pipe lines, by H. C. Price; gas welding of pipe lines, by T. W. Greene; progressive welding of pipe, by W. M. Neckerman; and a chapter on piping and fittings, by A. W. Moulder and D. H. Corey.

The book has a comprehensive table of contents and index, and is well illustrated.

Conventions and Expositions

National Industrial Advertisers Association: Annual conference, September 21-23, Cleveland, Ohio. Committee Chairman, Stanley Knisely, Advertising Manager, Republic Steel Corp., Republic Bldg., Cleveland, Ohio.

Iron and Steel Exposition: September 27-30, Cleveland Public Auditorium, Cleveland, Ohio. Under the direction of the Association of Iron and Steel Engineers, Empire Bldg., Pittsburgh, Pa.

American Welding Society: Annual meeting (in conjunction with Metals Congress Exposition), October 16-21, Book-Cadillac Hotel, Detroit, Mich. Secretary, M. M. Kelly, 33 W. 39th St., New York, N. Y.

American Public Health Association: Annual meeting, October 25-28, Kansas City, Mo. Headquarters Office, 50 W. 50th St., New York, N. Y.

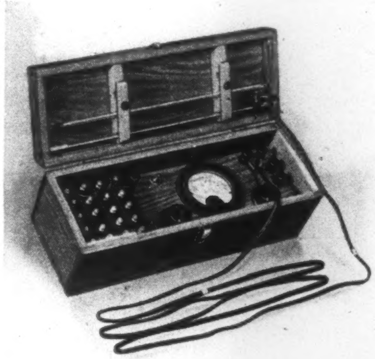
Power Show: National Exposition of Power and Mechanical Engineering, December 5-10, Grand Central Palace, New York, N. Y. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 118. Add the new products and companies listed here to your Directory Section which you received in your January, 1938, HEATING, PIPING AND AIR CONDITIONING and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

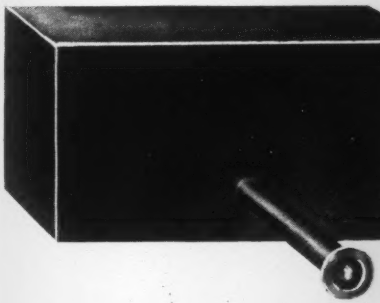
Instrument Determines Air Velocity

No. 1499**—The new "Thermo-Anemometer" is for use in determining air velocity in air conditioned buildings, ducts, and at exhaust hoods. It is accurate over a range of velocities of about 0 to 6000 fpm, according to the maker.



Operation, while not direct reading, is simple. To determine air velocity at a given point, the bulb of the heated thermometer is held at the point and the temperature read as soon as it attains equilibrium. (Thermometer bulb is heated by passing electrical current through resistance wire on bulb from batteries contained in instrument case.) The voltage used should be such as to give a temperature difference between the heated thermometer and the regular thermometer of not less than 15 deg. Accuracy increases with an increase in temperature difference; consequently, a differential of 25 to 35

TALLMADGE
Zoned Controlled
HEATING



The AIROTHERM which is controlled by outside temperatures and wind, automatically keeping down operating costs and providing greater comfort, is an outstanding feature of Tallmadge Zoned Heating.

BETTER HEATING AT LESS COST
GIVES GREATER COMFORT
Improves Air Conditioning

WEBSTER TALLMADGE & CO.
NEW YORK CITY

MEET HEATING NEEDS IN U. S. PRINTING & LITHOGRAPHING CO.

Owners of Large Baltimore Plant Use Webster Moderator System To Insure Balanced Heating

Coal Savings $1125 Yearly Average

Proper Temperatures Maintained in All Sections of Building Regardless of Weather

SYSTEM IS SELF-LIQUIDATING

Baltimore, Md. — Maintenance of the varied temperatures required in the large plant of the U. S. Printing & Lithographing Co. has been accomplished since 1935 with a Webster Moderator System of Steam Heating.

Keeping the press room at 75 degrees, office sections at 72 degrees and the remainder of the building at 65 degrees, regardless of outdoor weather conditions, a 4-zone Webster Central Control has met a difficult assignment well.

U. S. Printing & Lithographing Co.
Baltimore, Md.
East Wing—above West Wing—below

In addition to providing balanced heating service, the Webster Moderator System has allowed the U. S. Printing & Lithographing Co. to reduce the cost of heating an average of $1,125.00 per season. The cost of heating modernization is being recovered out of coal savings.

There is a total of 24,893 sq. ft. of installed direct radiation.

With the Webster Moderator System, an Outdoor Thermostat automatically adjusts the basic rate of steam delivery in accordance with weather conditions.

These before-and-after facts point the way to maximum comfort and economy in heating new buildings as well as in modernization of existing installations. Consult your architect, engineer or heating contractor. Or address

1888 WARREN WEBSTER & CO., CAMDEN, N. J. 1938
Pioneers of Modern Steam Heating
50 YEARS OF HEATING PROGRESS
Representatives in 60 principal U. S. Cities

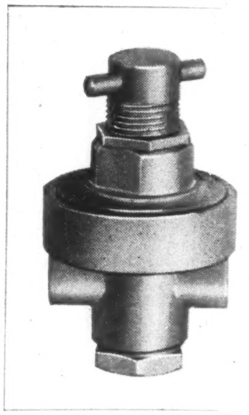
WEBSTER
MODERATOR
CONTROL
"Control-by-the-weather"

deg is desired where practicable. Knowing temperature difference and voltage, velocity may be read direct from the chart accompanying the instrument.

Use of such an instrument in the operation and maintenance of a dust control system was described in the May H. P. & A. C. by Donald E. Frazier.—Willson Products, Inc., 348 Thorn St. Reading, Pa.

Offers New Air Pressure Regulator

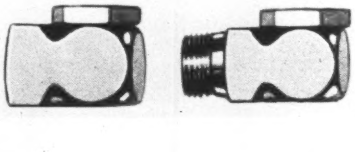
No. 1500—The new regulator for reducing and stabilizing air pressures illustrated here has been made possible by the manufacturer's patented process of die casting alloys into finished regulator parts, it is announced. The regulator incorporates time tested and proved principles of pressure regulation to make it safe, accurate and dependable in operation with a large volume delivery if desired, says the maker.

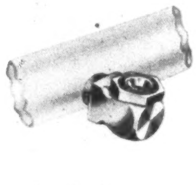


The two standard models are ¼ in. female pipe thread side inlet and outlet, and ¼ in. male pipe thread rear inlet and ¼ in. female pipe thread side outlet. In addition, special adaptations may be made, gages may be installed in all regulators, a double outlet may be provided if desired, special brackets may be attached, a permanent adjustment device may be incorporated, or ⅛ in. pipe thread connections may be furnished—C. H. Dockson Co., 2892 E. Grand Blvd., Detroit, Mich.

New Spray Nozzles Announced

No. 1501**—New "Whirljet" non-clogging spray nozzles give a uniformly distributed, highly atomized, hollow cone spray, according to the manufacturer, and are offered for use in air conditioning, air washers, water cooling, brine spraying and heat exchangers in general. Capacities range from 0.1 to 107 gpm at 10 lb pressure. All sizes and capacities are carried in stock made of brass. Some sizes are available also in stainless steel and other durable materials.





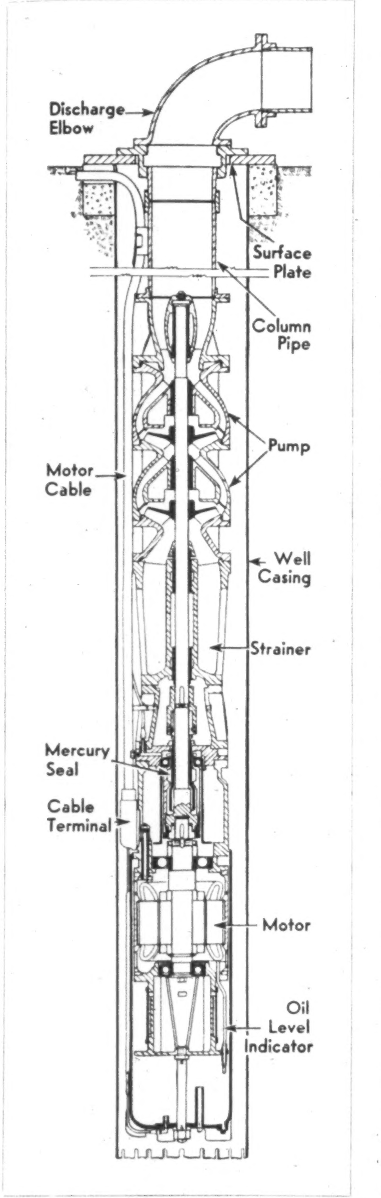
The same manufacturer also offers a newly designed non-clogging roof spraying nozzle which has a wide angle to give a wide coverage in a height less than the average parapet wall. These nozzles are supplied with city water or condenser cooling water for spraying roofs to avoid wasting the water and to reduce temperatures on top floors of buildings in order to cut cooling costs. The cost of installation is low, it is stated, due to the small number of nozzles necessary and the small amount of water required to keep the roof moist.—Spraying Systems Co., 4922 W. Grand Ave., Chicago, Ill.

Metallized Gaskets Offered

No. 1502—A new line of corrugated metal-asbestos gaskets is treated with a special metallic compound which, it is claimed, adds greatly to resistance to heat, pressure, moisture and corrosion. It is also said that this metallic coating prevents the asbestos from sticking to flanges and minimizes damage to gaskets from handling.—Goetze Gasket & Packing Co., Inc., 60 Allen Ave., New Brunswick, N. J.

Deep Well Pump Has Several Features

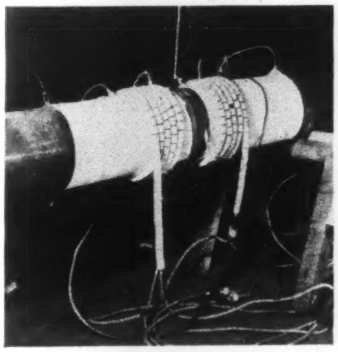
No. 1503—The "Submersible" deep well turbine pump represents a departure in that the motor is below and not above the turbine bowls. The propelling shaft is very short and the unusually long small diameter motor operates submerged at all times in the well water. However, the liquid pumped does not come in contact with the electrical parts or motor bearings, as these are enclosed in an oil filled case with a mercury seal where the shaft passes through at the top.



The turbine and motor form a compact unit attached to and supported by the discharge pipe. A submarine armored cable and a small copper oil tube form the only connection (aside from the discharge pipe) between the pumping unit and the ground surface. The pump is said to operate equally well in deep or shallow wells, crooked or straight wells, sumps or natural bodies of water.

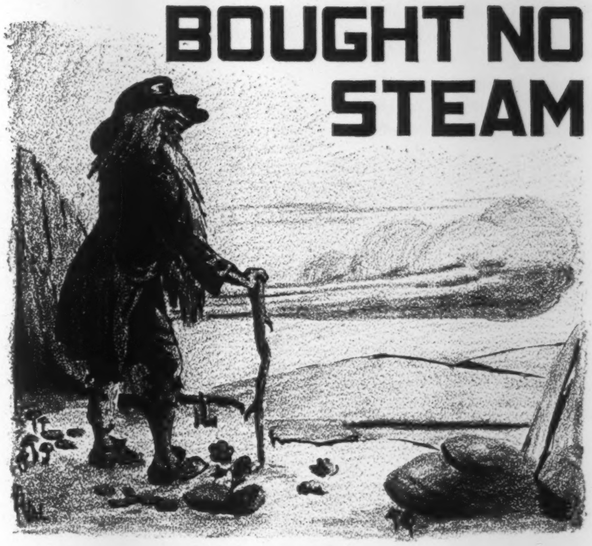
The motor is a squirrel cage induction type and its rotor is carried on two ball bearings, one of which is a radial thrust to take both the weight of the rotary parts and the hydraulic load. The chief function of the other bearing is to center the rotor. A high dielectric oil is circulated through the windings continuously and the small copper tube affords a means for replenishing the oil supply, although this is rarely necessary. — Byron Jackson Co., Dept. 216, 2150 E. Slauson Ave., Los Angeles, Cal.

Wrap Around Units Preheat Pipe for Welding



No. 1504—A unit offered for preheating and stress relieving in pressure pipe welding, valve welds, nozzle attachments, etc., is a wrap around type consisting of a heating coil of varied lengths provided with insulating bushings. These heaters are suitable for a maximum temperature of 1200 F and are furnished in such lengths and capacities to conform with specifications for re-

RIP VAN WINKLE BOUGHT NO STEAM

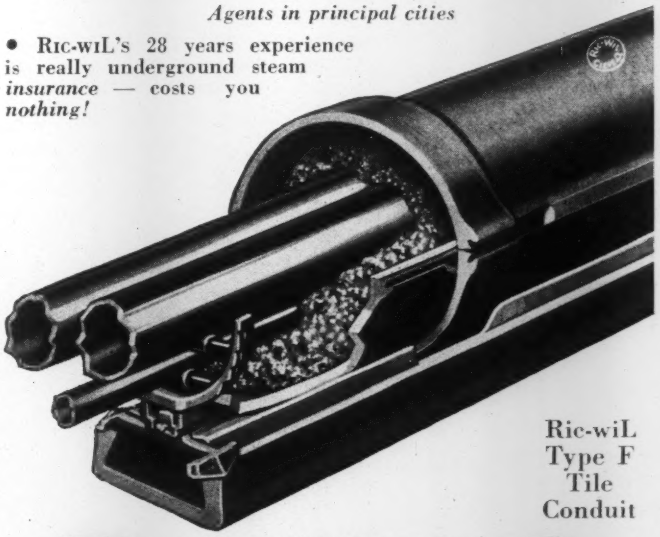


RIP sawed wood for 20 years. He slept and snored while the world went on. But *you* can't sleep for 20 years and forget your steam lines underground — unless they're protected by Ric-wiL Conduit. In less than that time, steam lines with insufficient protection will be gone with the wind. Steam itself plus the forces of nature will destroy your investment. A Ric-wiL System, with incomparable Dry-paC Insulation, will allow you to imitate Rip as far as steam lines are concerned.

Ric-wiL Conduit for steam power and heating lines is a sectional system built of vitrified, glazed Tile (also furnished in Cast Iron and in Armco Iron Units). Standard Ric-wiL is insulated with patented Dry-paC Waterproof Asbestos, but loose commercial insulation or sectional pipe covering may be had if desired. Ric-wiL with Dry-paC, as proved by reliable tests, gives over 90% efficiency on the line. Upper and lower halves of Ric-wiL Conduit are interlocked by the Loc-liP cemented joint. End joints of conduit and base drain are staggered—another interlocking feature. Ric-wiL provides adequate drainage and entirely closed construction. Complete service on layout, manufacture, and installation. Write for latest bulletins.

The Ric-wiL Co., Union Trust Bldg., Cleveland, Ohio
New York San Francisco Chicago
Agents in principal cities

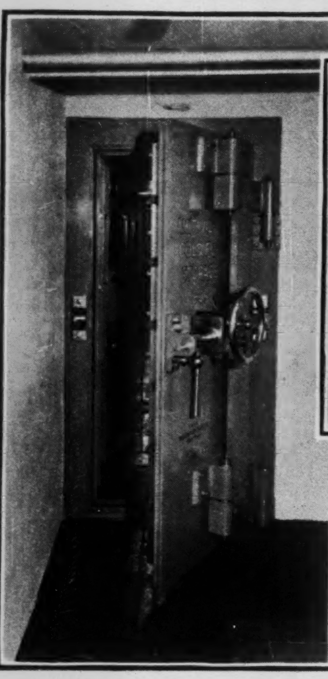
- Ric-wiL's 28 years experience is really underground steam *insurance* — costs you *nothing!*

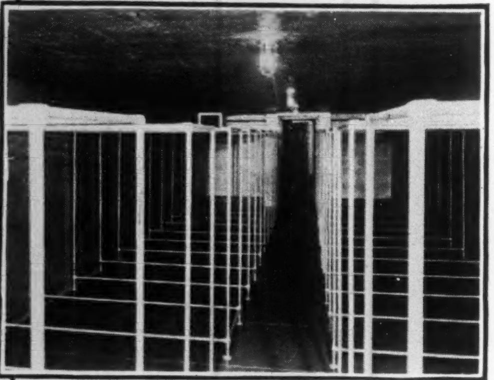


Ric-wiL Type F Tile Conduit

Registered in U. S. Patent Office
. Ric-wiL .
CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

SAFE.. fur storage.. with Valves by.. AP





- INSTALLATION
  Bendursky Fur Storage
  Amityville, Long Island, N. Y.
- EQUIPMENT
  General Electric
- INSTALLED BY
  Rex Cole, Inc.
  Long Island City, N. Y.
- VALVES AP

REX COLE INC. 25-11 HUNTERS POINT AVE. LONG ISLAND CITY N. Y.

April 29, 1938.

Automatic Products Company
404 Fourth Avenue
New York, N. Y

Attention Mr A Brandt

Gentlemen.

We are pleased to state that with the use of the Automatic Products Company thermostatic expansion valve, we have reduced our service calls, that may be attributed to expansion valves by some thirty per-cent, and can recommend the application of the Automatic Products Company thermostatic expansion valve for all applications used in the refrigeration industry.

We have used this valve exclusively for the past two and one-half years with very satisfactory results.

Very truly yours,
REX COLE, INC
J. L. Roth
MANAGER
COMMERCIAL INSTALLATION
AND SERVICE DEPARTMENT

JLRoth:mef

GENERAL ELECTRIC TEN BEST HOME SERVANTS

Refrigeration Parts Jobbers, Who Recognize Quality, Stock AP Valves.

Summer protection of expensive furs places exacting demands on Air Conditioning and Refrigeration Equipment. . . . For thousands of dollars in furs, and the goodwill of a community depend upon the maintenance of constant cold temperatures and the proper humidity ideally suited to fur storage. Here, too, the dependable and consistent efficiency of A-P Valves provides service-free operation that means complete customer satisfaction.

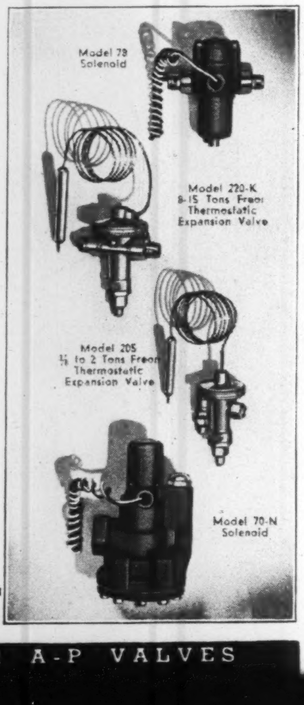
That's why A-P Expansion Valves and Solenoids are being used so extensively, and praised so enthusiastically by the leading engineers in the industry. A-P Valves enjoy a well-earned fame for Dependability, for leakproof supersensitivity and accuracy of temperature control that ordinary valves cannot equal.

Why not "switch to A-P" on YOUR next job? You'll enjoy the results!

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE WISCONSIN

Export Dept., 100 Varick Street, New York City

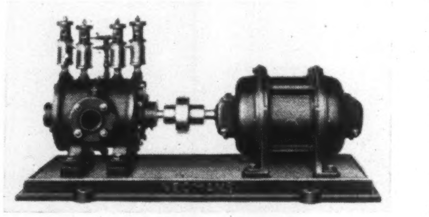
DEPENDABLE
THE BYWORD FOR A-P VALVES


Model 78 Solenoid
Model 220-K 8-15 Tons Freon Thermostatic Expansion Valve
Model 205 ½ to 2 Tons Freon Thermostatic Expansion Valve
Model 70-N Solenoid

quired distance to be heated on each side of the weld. When preheating, a coil of the proper size is placed on each side of the weld leaving sufficient space at the weld to avoid crowding. After the welding and preheating cycle is completed a third coil is added over the welding space to raise the joint to stress relieving temperature. In this manner a complete heating cycle is obtained from start to finish without removal or replacement of units.

Automatic temperature control panels for controlling the temperature at as many points on the joints as may be required are available. The manufacturer also offers solid type heaters split lengthwise in two sections for use on each side of the weld when preheating. After completion of this cycle the heater sections are moved together over the joint and raised to stress relieving temperature.—H. O. Swoboda, Inc., 13th St., New Brighton, Pa.

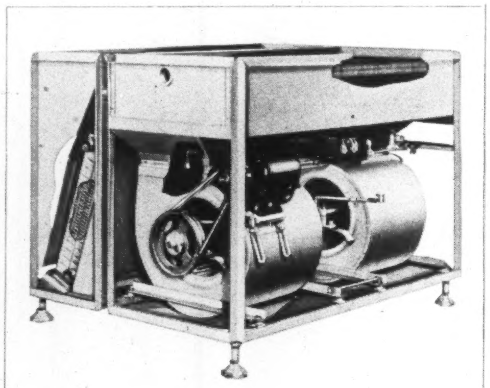
Compressors and Vacuum Pumps Have Composition Blades



No. 1505—An innovation for rotary air compressors and dry vacuum pumps is the substitution of composition blades for steel. The new blades are made of phenolic material which the manufacturer states is very tough and hard and yet soft enough so that with the blade edges running on the bore of the cylinder there is no wear of the bore or other parts of the housing or rotor due to blade contact. Both cylinder and blades acquire a high glaze with consequent low friction losses, perfect seal and high efficiency, states the maker. Construction of the machine is simplified with resultant increased life and reduced maintenance and repair costs.

In shop tests there have been no blade breakages; if one of the blades should break it would be pulverized without damaging the cylinder or rotor.—Yeomans Brothers Co., 1433 N. Dayton St., Chicago, Ill.

Adds Central Type Air Conditioner



No. 1506—A new central type air conditioner for commercial and residential applications is intended for use with steam or hot water boilers to provide every function of year 'round air conditioning—cleaning, circulating, heating, and humidifying in winter; and cleaning, circulating, cooling and dehumidifying in summer. A patented feature is the maker's system of synchronized control of all the air conditioning functions.

The unit is available in several sizes and capacities for steam and hot water heating, and for cold water or "Freon" cooling. Heating capacities range from 258,000 Btu per hr (2 lb steam, 65 F entering air) to 391,000 Btu per hr. The unit is equally adaptable to straight air conditioning or to the split system of air conditioning and heating, the manufacturer states.—Modine Mfg. Co., 17th St., Racine, Wis.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

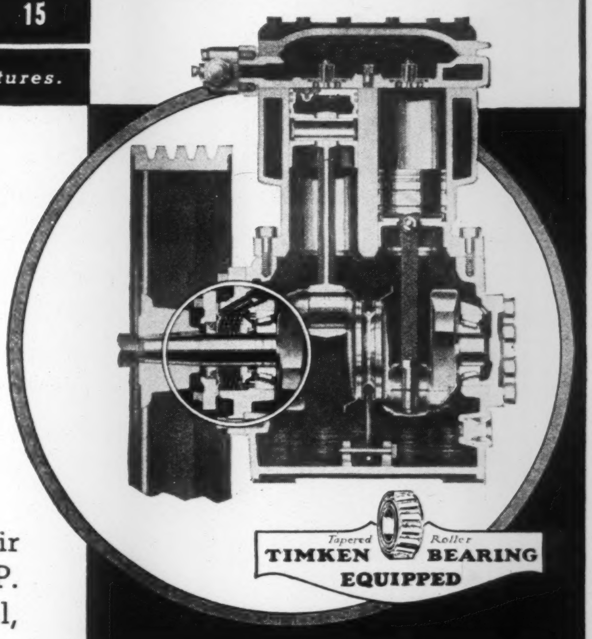
No. 7 of a Series of Curtis Advanced Engineering Features.

CURTIS Patented Oil Retainer Insures Long Seal Life and Prevents Leakage . . .

● The Curtis patented oil retainer keeps the seal totally covered with oil even during long shut-down periods — the Curtis seal can't dry out, thus preventing the possibility of refrigerant leakage.

Curtis outstanding performance is proven in thousands of installations. There's a Curtis model for every refrigeration and air conditioning requirement, from 1/6 to 30 H. P. — precision engineered to deliver economical, efficient, care-free performance.

Write to Curtis for full information on the complete Curtis line.

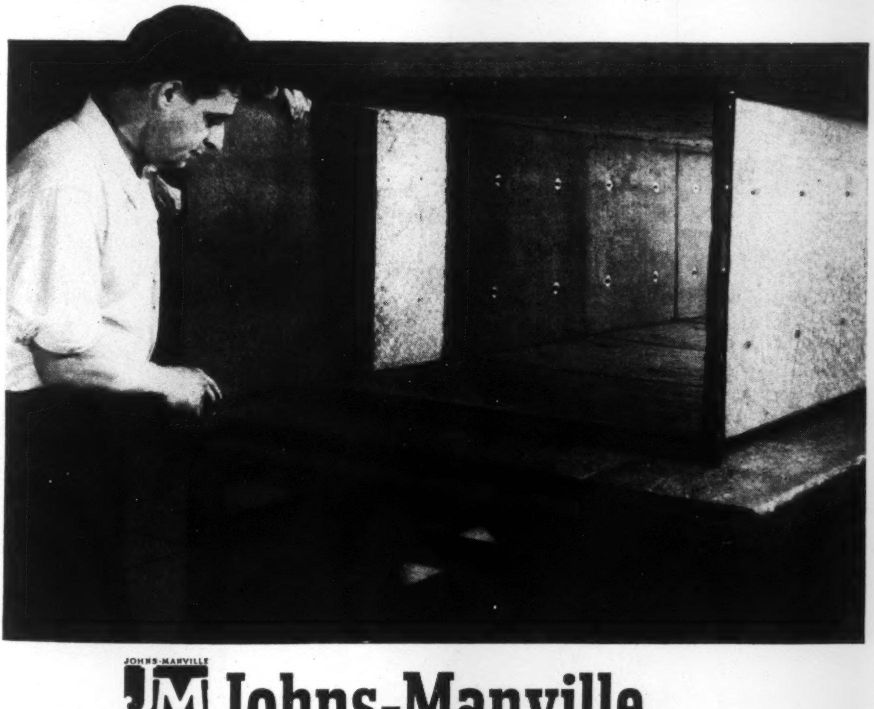


CURTIS

"Builders of Condensing Units Since 1922"

CURTIS REFRIGERATING MACHINE CO.
Division of Curtis Manufacturing Co.
1950 KIENLEN AVENUE ST. LOUIS, MO.

STOPS FIRE as well as NOISE



DANGER of fire starting and spreading in duct linings is too serious a question to overlook.* Particularly when it can be avoided with a lining material that combines unusually high sound-absorption qualities with complete fire-safety.

J-M Airacoustic Sheets do exactly that. Entirely mineral in composition, they provide as high as 70% sound-absorption. And they *cannot burn or smolder* . . . will not contribute to the spread of fire.

Moreover, J-M Airacoustic Sheets are light in weight . . . easily handled and easily applied. Their transverse strength is high, thermal conductivity low. And, because Airacoustic Sheets are highly resistant to moisture, they are exceptionally free from the dangers of humidity.

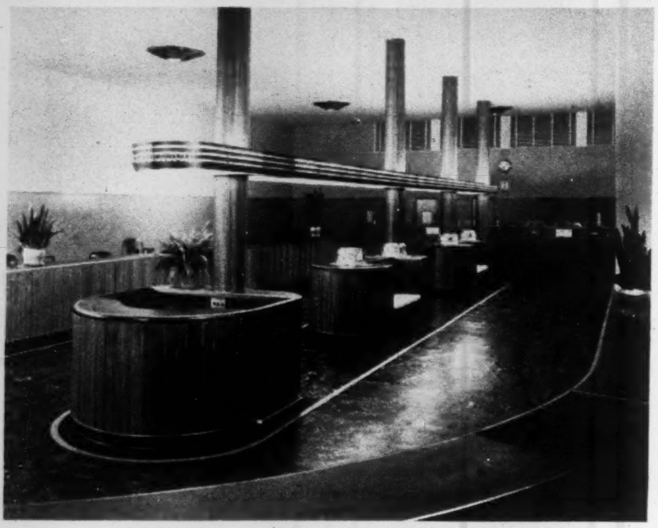
Get all the facts. They'll show you how you can use J-M Airacoustic Sheets on all your duct-lining jobs to both your clients' and your own advantage. For full details, write Johns-Manville, 22 East 40th St., New York, N. Y.

*A recent bulletin from the National Board of Fire Underwriters reports several cases of this very nature.

JOHNS-MANVILLE JM PRODUCTS **Johns-Manville**

AIRACOUSTIC SHEETS FOR DUCT LINING

Draftless Air Distribution



INDUSTRIAL FEDERAL SAVINGS & LOAN ASSOCIATION
DENVER, COLORADO
Burnham Hoyt
Architect
Benj. A. Brickham
Cons. Eng.

The ultimate in design is achieved when Architect and Engineer combine to attain functional beauty. The strikingly modern banking room shown is an excellent example of such a combination.

The Anemostats provide draftless distribution of the conditioned air during both heating and cooling cycles and cause equalization of temperature.

The Anemostat is an accepted scientific achievement. It has solved major problems of the air conditioning industry by reducing the speed of air flow to such an extent that it is no longer perceptible as a draft and by mixing room air within the device. Its use therefore permits greater temperature differentials, smaller ducts, smaller plants, lower installation and operating costs.

The Anemostat can be applied to existing systems as well as to new installations.

The Anemostat has no moving parts and is easily installed.

INSTALLATION DATA

Length of Room—78'
Width of Room—49'
Ceiling Height—16'
Anemostats—6 No. 40 TYPE B
Neck Diameter—16"
Largest Cone Dia.—40"
Velocity in Neck of Anemostats—1000 FPM
Volume of Air through each Anemostat—1400 CFM
Temperature Differential for Heating—30° Approx.
Temperature Differential for Cooling—22° Approx.

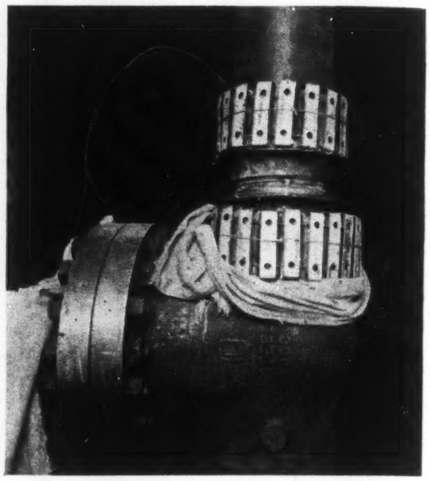
ANEMOSTAT CORPORATION OF AMERICA
10 EAST 39TH STREET, NEW YORK

ANEMOSTAT
"No Air Conditioning System is better than its Air Distribution"

AN-23

Preheater for Welding Alloy Pipes

No. 1507—Advantages of a flexible electric preheater for use on alloy pipes for welding are—according to the maker—speed of installation, simplification of operation, low maintenance cost, accurate temperature measurement and the fact that it can be used to preheat pipes before welding and during welding without manual adjustment of the heating elements. Any temperature up to 600 F can be maintained during welding. Special advantage is the protection afforded the welder by the use of two blankets which insulate the heating apparatus from the welder without interfering with his work.

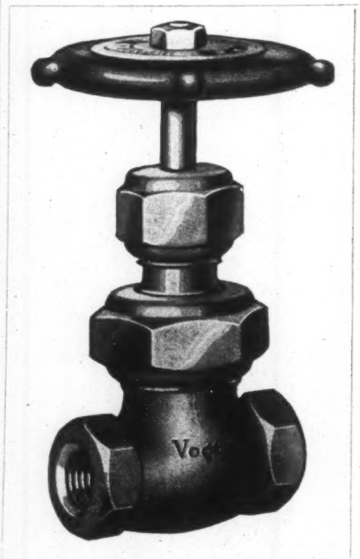


The equipment consists of an indicating pyrometer, a two heat switch and an arrangement of adjustable heating elements in a connecting linkage which holds the elements in contact with the pipe. It is stated that a temperature of 600 F is reached in less than 45 minutes on 6 in. carbon-moly pipe.

The equipment operates on 220 volt power, single phase, and the heaters are arranged to heat a distance of approximately 4 in. on either side of the weld.—Detroit Electric Furnace Co., 825 W. Elizabeth St., Detroit, Mich.

Announces Drop Forged Meter Valves

No. 1508—A line of drop forged steel, union bonnet type, meter valves in ¼, ⅜ and ½ in. sizes has been announced. Features of this type of valve include hexagon body ends, a ground joint between body and bonnet, a stem that can be easily reground or replaced, and a valve that may be repacked under pressure.



The valves are recommended by the maker for 900 lb working pressure at 750 F or 1500 lb nonshock cold working pressure. They may be had "all carbon" or "all stainless" steel and are stated to be especially suitable for applications where close, dependable and safe regulation is important.—Henry Vogt Machine Co., 10th and Ormsby Sts., Louisville, Ky.

Motorizes Pipe Vise Stand

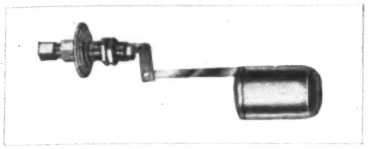
No. 1509—A pipe vise stand of the usual type but equipped with a power unit and chuck enables the user to thread, cut and ream all sizes of pipe up to and including 2 in. by power. The pipe is gripped in a universal, bar operated, scroll type chuck and is revolved by the power unit which is concealed in the upper part of the stand on which the vise is usually mounted. The motor can be connected to an ordinary 110 volt lighting circuit and the speed of the chuck is variable from 14 to 32 rpm.

In use, the die stock, cutter or reamer is placed on the pipe in conventional manner with the handles resting on sliding arms built in the sides of the stand. When the power is turned on, these sliding arms take the torque of the pipe tools.

Weight of the unit without legs is but 110 lb so that two men can lift it on or off a truck.—Oster Mfg. Co., 2057 E. 61st Pl., Cleveland, Ohio.

New Water Feeders Announced

No. 1510—A new series of low cost water feeders has recently been announced. The unit illustrated is only 7 in. in length, has a nickel plated copper float $1\frac{1}{2}$ in. in diameter by $2\frac{5}{16}$ in., and operates the valve with as little as 1 in. in water. A thumb screw adjustment on the float arm governs the water depth at which the valve closes.

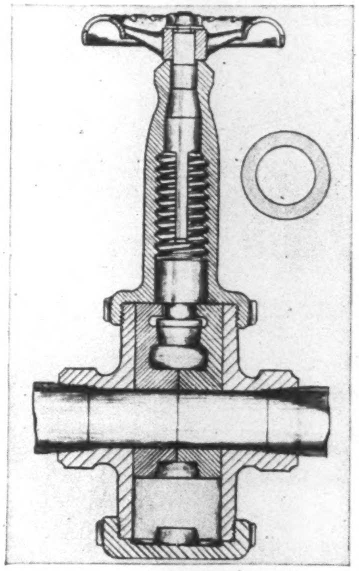


Features include a valve with a raised seat, with a valve stem which has an incased heat and oil resisting "Duprene" seat washer; a large filter with a "Monel" screen; entire valve nickel plated; and bearings of "Monel."

Unit is installed through a $\frac{5}{8}$ in. hole in the wall of the humidifier pan and is equipped with two lock nuts to make the valve tight to the humidifier.—Maid-O'-Mist, Inc., 180 N. Wacker Dr., Chicago, Ill.

New Valve Features Stream Flow

No. 1511**—New packless, cylindrical "Stream-Flow" gate valve is suitable for high as well as low pressures and temperatures; it has the salient features of both gate and plug valves but none of their disadvantages, the maker states. It is available in sizes ranging from $\frac{1}{2}$ to 8 in. in the standard metals and in special metals and alloys for lines handling corrosive liquids and gases.



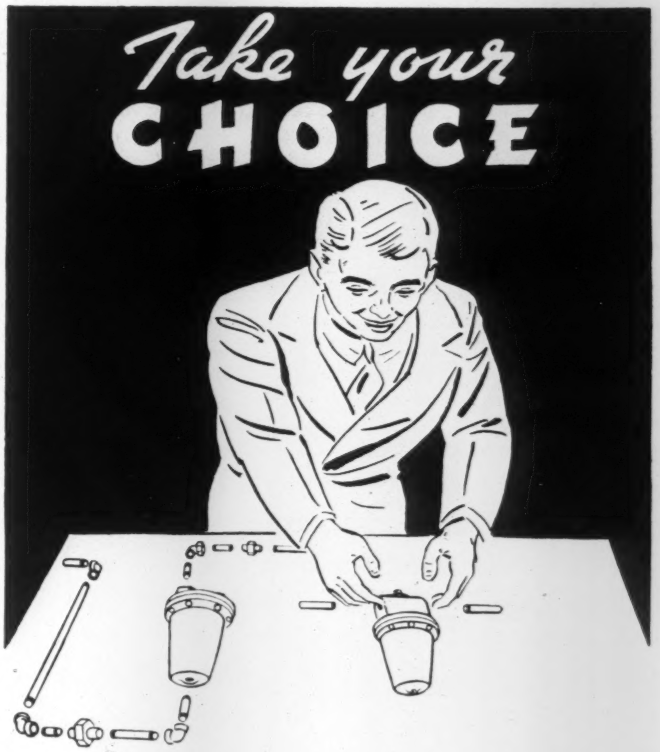
The body carries a cylindrical bore at right angles to the line of flow. A cylindrical gate is moved up and down by means of a screw in the valve bonnet and is prevented from turning by a key in the cylindrical bore. The run of the valve conforms in shape and size to that of the pipe. There are no cavities.

No packing is required. The only operating part in the line of flow is the gate itself. A cap on the bottom of the body and the removable bonnet permit cleaning the valve while it is in the line.—Monat Valve & Forge Co., 900 Bessemer Bldg., Pittsburgh, Pa.

Gas Flow Meter for Low Differentials

No. 1512—The "Ring Balance" flow meter for low pressure gas measurement is designed for operating differentials as low

Take your
CHOICE



Which will you choose from the two inverted bucket steam traps shown above? That's an easy one to answer. The Anderson Super-Silvertop fits right into the line *as is*. With the other, an old style trap, you must buy and install all those extra fittings.

This saving in fittings and labor is only one of the many Anderson Super-Silvertop advantages. Extra capacity of Super-Silvertops usually offers a saving in size of trap. Maintenance costs are less because Anderson traps are noted for their long life; besides, Super-Silvertops are inspected without removing trap from the line. This saves maintenance labor. No strainer is needed with Anderson Super-Silvertop traps since all passages are machined, hence do not clog with ordinary dirt and scale.

SUPER-SILVERTOP
STEAM TRAP

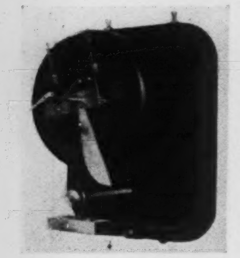
With all these advantages, Anderson Super-Silvertops cost no more than ordinary inverted bucket traps. That is why thousands of Anderson Super-Silvertops are sold each year, each trap backed by 54 years of steam trap manufacturing experience. Send the coupon for complete information. Don't be without it—write today.

THE V. D. ANDERSON CO.
1949 WEST 96th STREET • CLEVELAND, OHIO

Dear Sirs: Send me complete details of Super-Silvertop. I want to know more about it.

Name.................................... Company....................................

Address.................................... City and State....................................

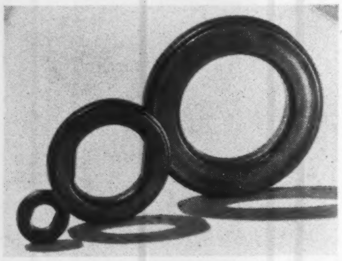


as 2 in. of water and is particularly applicable to measurement of gases at pressures below those for which the customary types of mercury sealed flow meters are suitable, says the maker.

The meter consists of a ring shaped hollow body, rotably supported on knife edges at its center, so as to be capable of turning freely. The annular body is partly filled with water, oil or antifreeze liquid, and is divided at the top by a partition wall, to each side of which a flexible tube is led for the purpose of subjecting the unit to the differential pressure from an orifice or flow nozzle through which flow is to be measured. When flow occurs through the orifice plate, the resultant differential pressure causes the liquid in the ring balance to be transferred from one side to the other, whereupon the ring balance rotates to a new position of equilibrium. Motion is maintained proportional to flow by a suspended weight and cam.—Cochrane Corp., 3161 N. 17th St., Philadelphia, Pa.

Offers Valve Disc for Universal Service

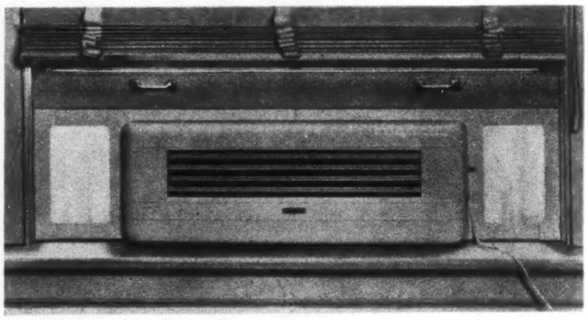
No. 1513—Users of globe valves with renewable discs will be interested in the announcement of an all-purpose disc recommended by the maker for handling air, gas, steam and liquids at any temperatures or pressures, for acids, alkalis or solvents, in fact for any service in which a globe valve can be used.



The disc is of laminated construction, built up of alternating layers of asbestos and metal completely encased in a two piece shell of copper, "Monel" or other alloy metal which protects the laminated parts. Made in sizes for ¼ to 12 in. valves, with round or oblong holes.—Goetze Gasket & Packing Co., Inc., 60 Allen Ave., New Brunswick, N. J.

Window Filter Unit of Modern Design

No. 1514*—New "Silentaire" window unit ventilates, filters, and circulates the air, as well as eliminating disturbing outside noises. Modern in design, it does not interfere with venetian blinds, curtains or drapes, and can be easily removed when washing windows.



It is offered for use in offices, hotels, hospitals, clubs, apartments, homes and other types of buildings.—Berger Mfg. Co., Div. of Republic Steel Corp., 1038 Belden Ave., Canton, Ohio.

Revolving Table Simplifies Welding

No. 1515—A convenience tool recently announced for the use of welders is a revolving table which the manufacturer says will save 30 to 50 per cent on welding labor on all cylindrical or circular products, reduce welding rod consumption, and simplify the

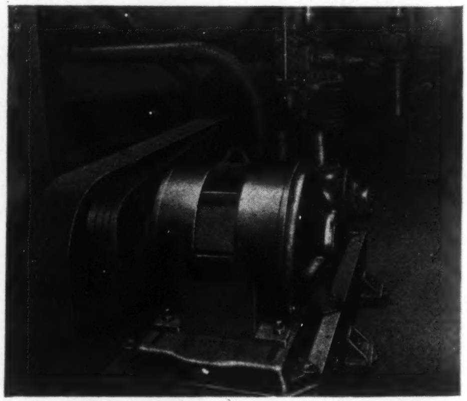
NEWS at the

TRANS-LUX

BAKER COMFORT COOLING "Featured" at News-Reel Theatres

TRANS-LUX
TRANS-LUX

● BAKER System Air Conditioning has made news in the Trans-Lux news-reel theatres of New York City because of its ability to handle unusual variations in the cooling load at minimum operating cost. Shorter programs at the Trans-Lux houses mean far greater "turnover" in attendance than is the case in theatres showing full-length or double features. BAKER equipment, however, proved itself capable of handling every change in cooling requirements with exceptional efficiency and economy. Doing the tough jobs better is an old BAKER custom. For BAKER'S answer to your particular air conditioning or refrigeration problem, write to



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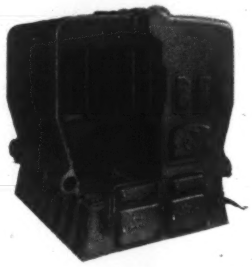
Branch Factories: Fort Worth, Los Angeles, Seattle. Eastern Sales: New York. Central Sales: Chicago. Sales and Service in All Principal Cities.

The Twin Sectional Cast Iron Made in 9 sizes. Rates from 7,850 to 19,450 sq. ft. of E. D. R. Steam Rating. Water from 12,000 to 31,800 sq. ft.



The Welded Steel Burnham—Made in 19 sizes ranging in capacities from 1,800 to 42,500 sq. ft.

Hank Sez That— Stretching The Truth Don't Get You Nowhere

There's some fellers who ain't got but one thing to sell, and so blows out their cheeks fur fair about it. Besides which they now and again take a slam at what the other fellers has what's different.

Now along that line, for argument sake, take boilers. The fellers what's got steel ones, find it alfired hard to see any good in a cast iron. And t'other way around too.

But when it comes to us Burnham folks, we make both kinds.

So all our getting hot and bothered about, is to make sure you get, which ever one that's the best one, for your job. There ain't no need of doing any truth stretching just ter make a sale.

Anyway, even if we did, it wouldn't get us no where. Wouldn't, because when you stretch truth, it's liable to break and snap back at you like an elastic does. And maybe too, sting you; and it oughter.

So am saying agin, we make the two kinds of boilers. Steel or Cast Iron. Which is at least, one more than some folks do.

Hank Hindle

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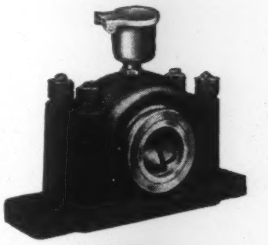
USE
Randall Bearings for Extra Service

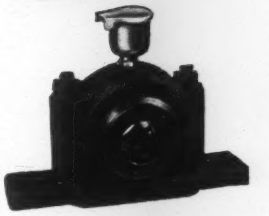
Here are some of the reasons why you get extra service when you use Randall Pillow Blocks:

- ● They are self-aligning
- ● They are self-lubricating
- ● They are silent in operation
- ● They have a low running torque
- ● They are made of finest materials
- ● They are precision bored (except small size Standard)

Randall Pillow Blocks are economical to use and require only a minimum of attention to last a lifetime. They are trouble-free in the field and give assurance to any manufacturer or contractor that there will be no bearing trouble in his unit.



*Randall Universal Pillow Block—An extremely versatile double reservoir bearing that can be mounted in any position simply by unscrewing the oil cup, turning the ball and reinserting the oil cup in a vertical position.



*Randall D. R. O. R. Pillow Block — This double reservoir bearing which approximates the high operating efficiency of the Universal is for use where the adjustment possible with the Universal is not required.

**Shown with large special oiler.*

Write for 1938 catalog describing, in detail, the complete line of Randall Pillow Blocks.

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New York City

American Stock Gear Co.
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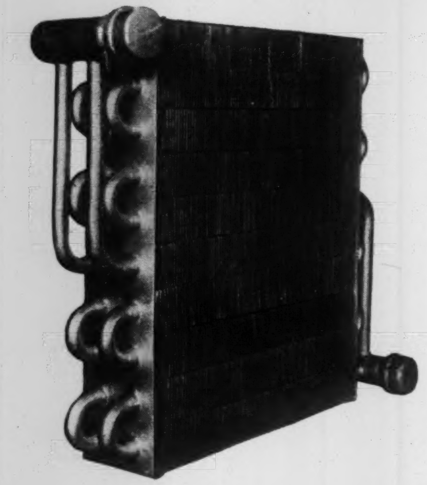
PACIFIC COAST STOCKS

Utility Fan Corp.
Los Angeles, Cal.

C. W. Marwedel
San Francisco, Cal.

Randall GRAPHITE PRODUCTS CORP.
Dept. 810 609 W. Lake St., Chicago, Ill.



BUSH AIR CONDITIONING COILS

Also coils designed especially for Cooling with Freon by Direct Expansion, Well Water, and Heating with Hot Water . . . carefully engineered to fit each job.

COIL DESIGNED FOR HEATING WITH STEAM

It is made in one section having a total of 100 square feet of Exposed Surface.

The Face dimensions are 20" high and 16" wide. The depth is 4".

The Coil is 10 rows high and 2 rows deep.

The Tube is ¾" O.D. tinned copper expanded into 2" square.

Aluminum Fins spaced 6 per inch.

It was designed for the following conditions:

C.F.M. 1100
F.P.M. 500
Entering Air 70° D.B.
Leaving Air 140° D.B. steam pressure 5 lbs.
Calculated Load 83,900 B.T.U.'s per hour.

In Steam applications Headers can be made of Tube, Pipe or Cast Iron depending on the type of work to be done and the quantities involved.

Fins can be made of Copper or Steel if it seems advisable.

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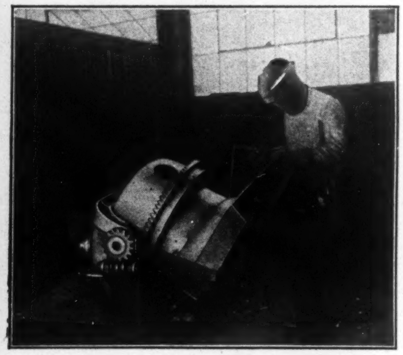
HARTFORD, CONN.

BRANCH FACTORY 610 N. OAKLEY BLVD. CHICAGO, ILL.

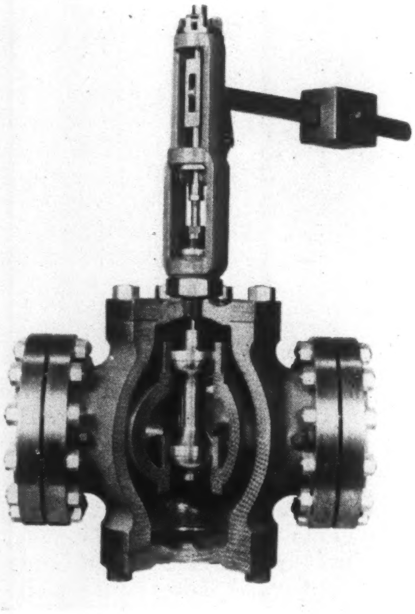


welding process. The table can be tilted beyond 90 deg from either side of horizontal and can be revolved at various speeds to accommodate various sizes of products and metal thicknesses.

The table may be held stationary in any position by a self locking worm gear and can be stopped and held stationary for welding of horizontal seams in the most accessible position. It is driven by an electric motor of the same current characteristics as the welding machine. —Ransome Concrete Machinery Co., Dunellen, N. J.

Balanced Lever Valves Announced

No. 1516—New balanced lever valves for use with steam, air, oil, hot or cold water, and almost any gas have a number of features. In the one illustrated the roller guided top works insure free valve movement, valve stem alignment, tight seating, long packing life, and minimum of friction, according to the maker.

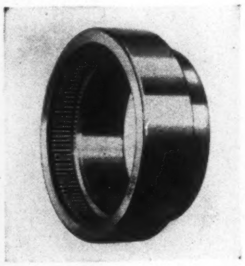


Features include valve stem roller guided top and bottom, "Nitralloy" rollers and roller pins, renewable seat rings, heavy walls, and precision machining throughout. Inner valve is available in parabolic type, flat type with bevel seat, V-port type with bevel seat, and V-port type non-seating.

Valves are available in any materials, ½ to 3 in. size (screwed ends), and 1 in. to 12 in. (flanged ends). When used with the maker's controllers they automatically govern inflow or outflow (reduction, relief, differential pressure, rate of flow, liquid level). —A. W. Cash Co., P. O. Box 135, Decatur, Ill.

Needle Roller Bearings Offered

No. 1517—Originally developed for wrist pin applications in internal combustion engines where the motion is oscillating, the load heavy, space restricted, and lubrication difficult, "Precision" needle roller bearings are now offered for many other difficult duties—cam rollers, planetary reduction gears, valve rocker shafts, pump shafts, idler gears, etc. According to the maker, they commend themselves in general for applications where minimum weight, low friction and highly concentrated load capacity are requisites. — Norma-Hoffmann Bearings Corp., Stamford, Conn.



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Copper Headquarters

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The exacting service demands of modern air conditioning systems make copper of extraordinary quality imperative. Hussey Copper is just that kind—Pure Lake Copper, if you please, recognized as the most enduring copper obtainable . . . super-armored against corrosion in nature's own crucible—verily the cream of nature's copper crop.

That is why Hussey, with its nationwide network of Eleven Sales Offices and Seven Warehouses has become Copper Headquarters for the quality-minded throughout the air conditioning industry.

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General Offices and Rolling Mills: PITTSBURGH, PA.

Would you like a copy of the latest Hussey Catalog?

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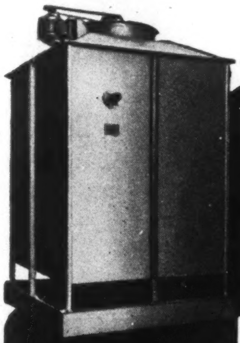
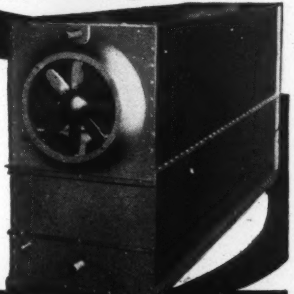


New Efficiency, Greater Economy in WATER COOLING for Small Equipment!

MARLEY's
New "Small Series" Line

A Really BIG Idea in Small Cooling Towers



Neat, Sturdy, Compact!
28 Standard Induced-Draft Models for Indoor or Outdoor Service.

A perfect solution to every small water cooling problem.

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SMOOTH RUNNING

The smooth, effortless stride of a champion foot-racer is a beautiful thing – every muscle responding in perfect rhythm. The smooth-running characteristics of Peerless Pumps are likewise an indication of their championship calibre – every part properly co-ordinated, working surfaces microscopically fitted, a mechanism, in short, as near perfection as human ingenuity knows how to produce. Write for latest catalog.

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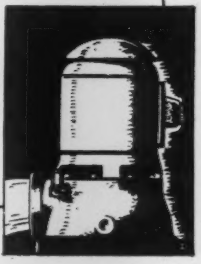
FOOD MACHINERY CORPORATION
Massillon, Ohio
Los Angeles, Calif. *San Jose, Calif.*



FOR ALL HEATING SYSTEMS UP TO 150# PRESSURES
SHAW·PERKINS
HIGH-PRESSURE
HEATING UNITS
SPECIAL UNITS AVAILABLE FOR HIGHER PRESSURES

SUPERIOR RESULTS WITH ALL PRESSURES

Combines the most advantageous features of convector—radiator—and unit heater. Approximates unit heater performance in air movement, while delivering desirable proportion of radiant heat. For all pressures on any type of heating system. At elevated steam pressures the surface temperatures are still lower than those of the conventional exposed types operating on low-pressure steam.

Write for Literature

SHAW-PERKINS MANUFACTURING COMPANY
OLIVER BUILDING . . . PITTSBURGH, PA.

Check its Simplicity

STRAIGHT-LINE CONNECTION
Makes dis-assembling and inspection easy, without disturbing piping . . .

COCHRANE BUCKET TYPE STEAM TRAP

Design and construction assure efficient operation and long life. Quick, positive action discharges condensate through full orifice area, preventing wire drawing and erosion of valve and seat. Water seal provided by inverted discharge tube permits bucket to regain buoyancy before complete discharge. Valve snaps shut without blowing steam. Bucket and valve are the only moving parts. Write for Publication No. 2663 telling how to select proper trap sizes.

Cochrane Corporation, 3131 N. 17 St., Philadelphia, Pa.

COCHRANE
STRAIGHT-LINE BUCKET TRAP

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 118. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 2879. AIR CONDITIONERS: Carrier Corp., Syracuse, N. Y. 4 p. bulletin announcing portable air conditioners with strip heaters and humidifiers for year around use. The strip heater will provide adequate room heating in warmer climates and serve as an accessory to heating systems in cold regions.

No. 2880. AIR CONDITIONING PRODUCTS: Peerless of America, Inc., 515 W. 35th St., Chicago, Ill. 64 p. catalog featuring complete description and data on new "High Dispersion" heat transfer surface which consists of extended surface with thousands of spines integral with the outer surface of the refrigerant tubing. Other equipment listed includes comfort conditioners, floor type units, ceiling type units, direct expansion coils, water coils for heating and cooling, steam coils, thermal expansion valves and evaporative condensers. Tables and charts for figuring air conditioning installations and selecting coils are presented.

No. 2881. AIR CONDITIONING UNITS: Refrigeration Economics Co., Inc., Canton, Ohio. 12 p. bulletin (E) on air conditioning units, evaporative condensers and banana room conditioners with descriptions, dimensions, list prices, capacity tables and data on estimating.

No. 2882. AIR EJECTORS: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 6 p. folder on steam jet air ejectors designed for air removal, condensation, dehydration, deodorization, distillation, evaporation, and impregnation.

No. 2883. AIR OPERATED CONTROLLERS: Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., 4534 Wayne Ave., Philadelphia, Pa. 6 p. folder on air operated controllers featuring their adaptability to the varied control requirements of industrial processing.

No. 2884. BEARINGS: Norma-Hoffmann Bearings Corp., Stamford, Conn. 6 p. circular outlining results of a study made with a view to safeguarding further the quality of the manufacturer's bearings including special testing of the lubricating grease used, and aluminum foil wrapping to protect polished bearing surfaces and the lubricating grease against deterioration.

No. 2885. BOLTS AND NUTS: Pawtucket Mfg. Co., Pawtucket, R. I. Leaflet announcing a full line of standard sizes of "Herculoy"—a silicon copper alloy—bolts and nuts.

No. 2886. CHECK VALVES: Crane Co., 836 S. Michigan Ave., Chicago, Ill. 8 p. booklet "Checking Up on Check Valves" describing the two basic types and their applications and giving a handy reference guide to the manufacturer's swing and lift types. Practical suggestions for selecting valves are included.

No. 2887. CONDENSATION RETURN UNITS: Decatur Pump Co., 2750 Nelson Park Rd., Decatur, Ill. 8 p. bulletin (104C) on "Burks" self-priming turbine condensation return units with descriptions, performance tables and dimension drawings.

No. 2888. CONDENSING UNITS: Modern Equipment Corp., Defiance, Ohio. 12 p. bulletin on "Par" condensing units for refrigeration with descriptions and specifications for air cooled and water cooled models.

No. 2889. CONTROLS: White-Rodgers Electric Co., 1209 Cass Ave., St. Louis, Mo. 6 p. condensed catalog (R-46) on "Hydraulic Action" controls listing their features and describing thermostats, warm air and hot water limit controls, fan and blower controls, combination controls, pressure controls, refrigeration temperature controls, stoker timers, relays, etc.

No. 2890. COPPER AND COPPER ALLOYS: Revere

NO MAINTENANCE TROUBLES WITH *this* UNIT HEATER

MODEL NO. 20
GRID
UNIT

Its heating sections (shown here with casing removed) are cast aluminum alloy, cast in one piece and bonded to high-test nickel alloy iron steam chamber. In it no two dissimilar metals are in contact with each other and steam or hot water to produce electrolytic action. Grid Unit Heaters never fall apart from corrosion. Their maintenance cost is practically nothing—some in use as many as 9 heating seasons without expense.

THE UNIT HEATER & COOLER CO., Wausau, Wisconsin
Offices in all principal cities

GRID
UNIT HEATER

MR. EMPLOYER—LET THIS *New Type of Craftsman*

MAKE A SAVING FOR YOU!

Quality equipment properly installed and correctly serviced is a winning combination you can always depend on to bring that satisfied customer's recommendation so valuable to every business. You've *always* been able to control the quality of your equipment; and NOW *you can control the quality* of your installation and service work.

More than 100 leading manufacturers are officially endorsing and recommending the Training Program being conducted by the Refrigeration & Air Conditioning Institute under the direction and supervision of factory engineers, working right in the industry, so as to provide you with a source of dependable, highly skilled refrigeration and air conditioning service engineers. This *New Type* of *Craftsman*, created especially for the Refrigeration and Air Conditioning Industry is, in a way, a composite of all the crafts employed in air conditioning work insofar as they are used in Air Conditioning installations. He can help you increase your net profits in three ways:—first, Eliminates the need for costly training; second, Reduce your service expense; third, Helps to develop new business through satisfied customers. He is then, a man who can become a definite asset to your business from the first day his name is added to your payroll.

The individual qualifications of each man trained by the Refrigeration & Air Conditioning Institute is recorded in a form which enables you to select, at a glance, the man best suited to your needs. . . . Mr. Employer, will you let us shoulder your *Training Costs* and help you solve your man-power problem?

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Division of the Industrial Training Corporation
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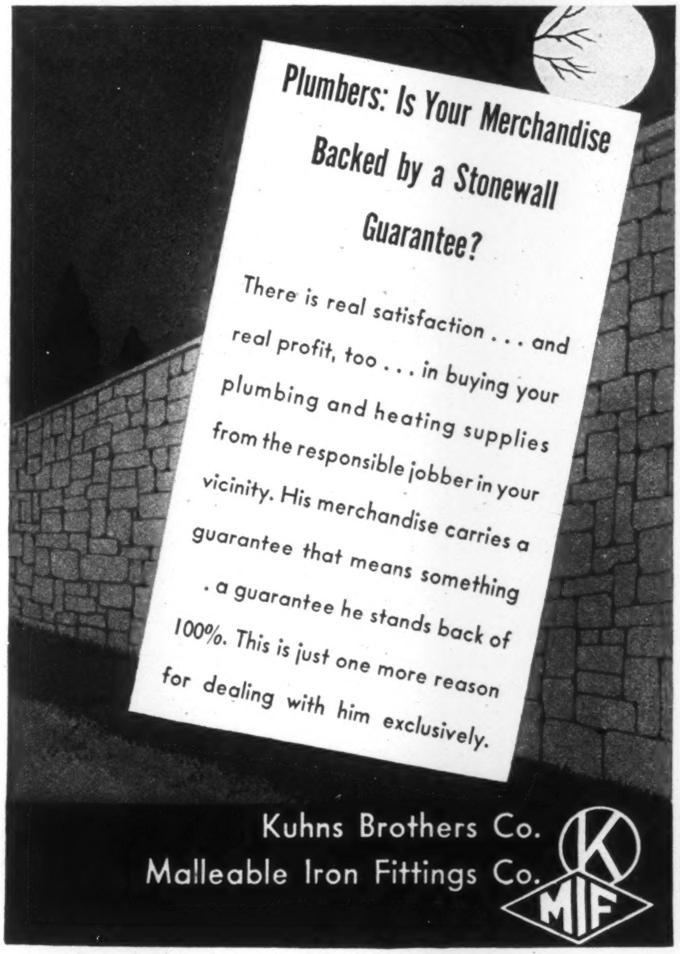
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Malleable Iron Fittings Co.
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There is real satisfaction . . . and real profit, too . . . in buying your plumbing and heating supplies from the responsible jobber in your vicinity. His merchandise carries a guarantee that means something . a guarantee he stands back of 100%. This is just one more reason for dealing with him exclusively.

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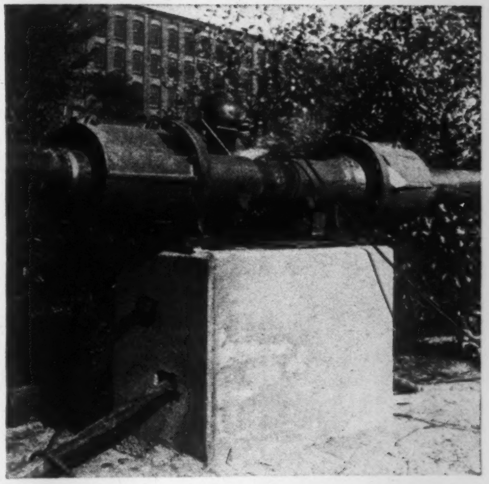

Buy This Joint for DEPENDABILITY

A completely guided joint—inside and out. Slip cannot pull out of body. No metal to metal contact between body and polished slip surface. Available in semi-steel, cast steel, or wrought steel for high or low pressures in single or double joints with or without anchor base and service connections.

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NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS

McQUAY Combination
COOLERS & HEATERS

An ideal unit for year 'round Air Conditioning purposes, lending itself to a very simplified application.

For Cooling either cold water or brine can be used.

For Heating either hot water or steam is efficient. This unit is very attractively designed and will fit into any surrounding in an excellent manner.

Special descriptive bulletin on McQuay Combination Coolers and Heaters is yours for the asking.

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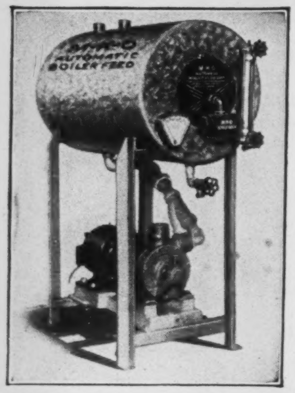

Automatically Maintains a Constant Water Level in High or Low Pressure Boilers . . . .

Wherever city water pressure is lower than desired steam pressure . . . wherever feed water must be pumped against high boiler pressure . . . condensate returned to boiler . . . and make-up water supplied . . . the M. K. O. Boiler Feed is needed. None other has all its features!

Bulletin 4-B gives details, write for it!

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MEARS-KANE-OFELDT INC.
Executive Offices and Factory
1903-1915 EAST HAGERT ST., PHILADELPHIA
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Copper and Brass, Inc., 230 Park Ave., New York, N. Y. Reprint giving a summary of the important properties and typical industrial applications of 30 representative coppers and copper base alloys. A large table presents handy reference data on composition, tensile strength, elongation, elastic limit, properties and uses, and methods of working.

No. 2891. DUCT INSULATION: Grant Wilson, Inc., 4115 W. Taylor St., Chicago, Ill. 8 p. bulletin (386) giving data on "Dux-Sulation" and its applications. A table of outside surface temperatures of ducts covered with this insulation and information on sound absorption are included.

No. 2892. DUST CONTROL: W. W. Sly Mfg. Co., 4700 Train Ave., Cleveland, Ohio. 24 p. bulletin (90) on dust control describing and illustrating the manufacturer's equipment and systems and including information on piping specifications. Also 4 p. bulletin (91) on the improved "Centri-Merge" wet dust collector, for use particularly with processes creating dust accompanied by acid, moisture or excessive heat.

No. 2893. ELECTRIC OPERATED CONTROLLERS: Foxboro Co., 106 Neponset Ave., Foxboro, Mass. 32 p. bulletin (184-2) on "Rotax" electric operated control instruments for applications where "open and shut" or two position control is desired. Over 60 illustrations and diagrams show installations and applications. Equipment for processes or operations involving temperature, pressure, humidity, liquid level and flow is described in detail.

No. 2894. FLOW CONTROL HEATING SYSTEM: H. A. Thrush & Co., Peru, Ind. 4 p. bulletin (EC-638) describing heat control devices for the manufacturer's flow control warm water heating system.

No. 2895. HEAT TRANSMISSION FROM SURFACES: Philip Carey Co., Wayne Ave., Lockland, Cincinnati, Ohio. 12 p. technical bulletin (102-A) on heat transmission from surfaces containing formulas, tables and curve sheets, showing rates of heat loss from curved and flat surfaces in both still air and air moving at various velocities. The data are valuable in establishing losses for uninsulated hot surfaces, and for use in heat transmission formulas where the rate of heat transmission from the surface is an important factor in determining the overall heat transmission through the structure.

No. 2896. INSULATION: Armstrong Cork Products Co., 994 Concord St., Lancaster, Pa. Issue of the "Insulator" (Vol. 8, No. 3) featuring a description of the insulation of the S. C. Johnson & Son office building in Racine, Wis., designed by architect Frank Lloyd Wright.

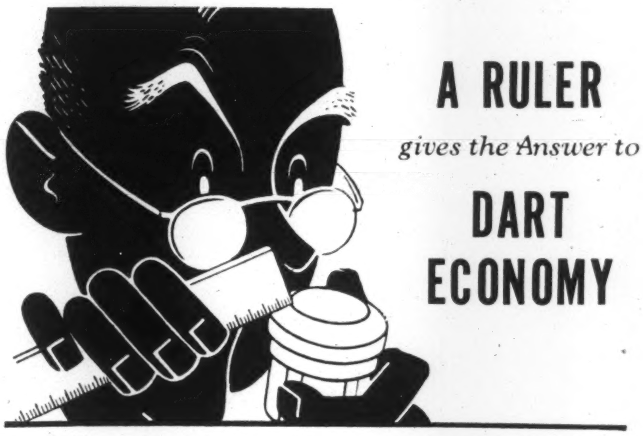
No. 2897. INSULATION: Crown Cork & Seal Co., Inc., Insulation Div., Baltimore, Md. 4 p. bulletin on "Electro-Processed" corkboard insulation for refrigeration purposes.

No. 2898. LEAD LINED EQUIPMENT: National Lead Co., 111 Broadway, New York, N. Y. Issue of "The Dutch Boy Quarterly" (Vol. 16, No. 2) including the fourth of a series of articles on lead lined equipment with data on acid resistant valves, pumps, tank connections and homogeneous lined and covered apparatus.

No. 2899. LUBRICATION: Texas Co., 135 E. 42nd St., New York, N. Y. Issue of "Lubrication" (Vol. 24, No. 7) devoted to selecting the lubricants for air conditioning and electric refrigeration machinery. Among the subjects covered are refinery procedure, various properties of lubricants, effect of the type of compressor on lubrication, function of the oil separator and designing for lubrication.

No. 2900. MECHANICAL TUBING: Joseph T. Ryerson & Son, Inc., 2558 W. 16th St., Chicago, Ill. 20 p. booklet announcing the addition of "Timken" mechanical tubing to the publisher's steel service. Information is included on its manufacture, machinability, applications and properties; pertinent tables and other data are presented.

No. 2901. METAL SPRAYING: Schori Process Corp., 110 E. 42nd St., New York, N. Y. 4 p. bulletin describing a new process using powdered metals (particularly silica-zinc) and



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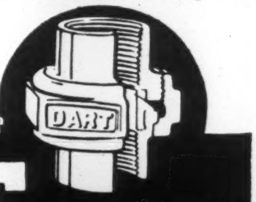
These seats are precision machined to a true arc, then ground to spherically accurate surfaces that match all around, tighten up to a true ball joint, come apart readily, remake repeatedly.

And what's more, you'll find only top notch materials in Darts; air-refined malleable iron bodies and nuts that won't take a beating from pipe strains or wrench abuse—special bronze alloy seats that resist pitting, corrosion, electrolysis. Let us send you a Dart to try at our expense. Write.



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SALES AGENTS: THE FAIRBANKS COMPANY, NEW YORK, AND ALL BRANCHES

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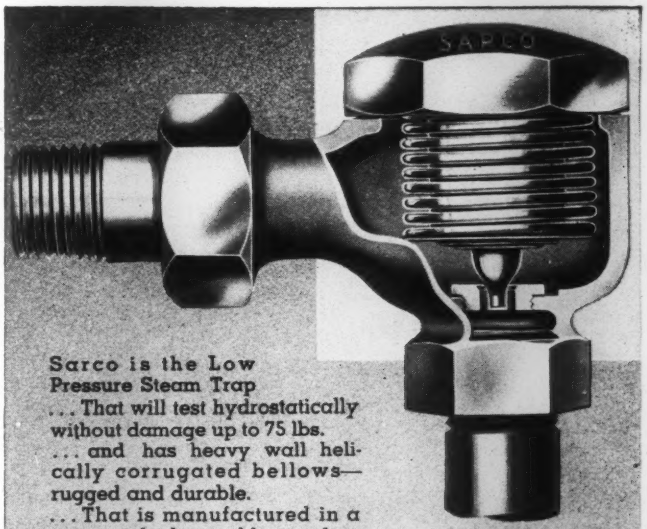

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. . . That will test hydrostatically without damage up to 75 lbs.
. . . and has heavy wall helically corrugated bellows—rugged and durable.
. . . That is manufactured in a new and thoroughly modern plant devoted exclusively to steam heating specialties.
Install Sarco traps, valves, regulators, and accessories. Get the protection of unit service and responsibility on one order.

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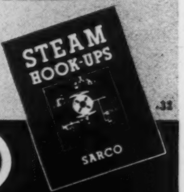
—On your business letter-head. Shows how to hook up all types of heating, air conditioning and process equipment with suitable traps and control.



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THERMOSTATIC, FLOAT AND BUCKET TRAPS, REGULATORS AND HEATING SPECIALTIES
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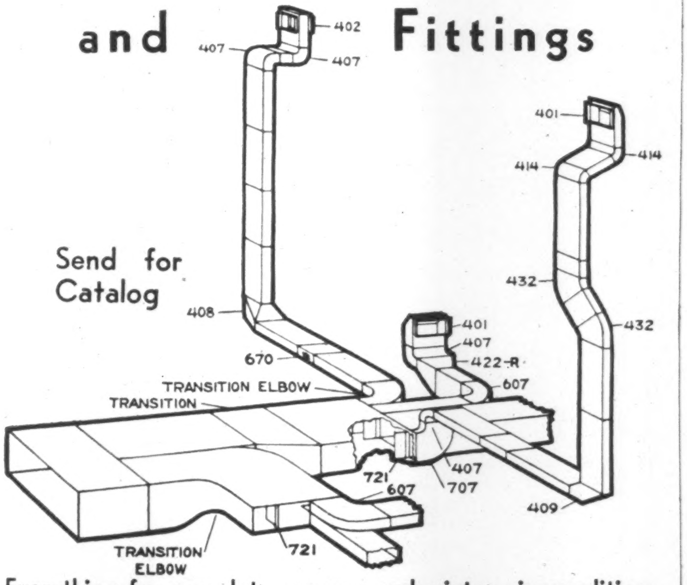
Air Conditioning Pipe and Fittings



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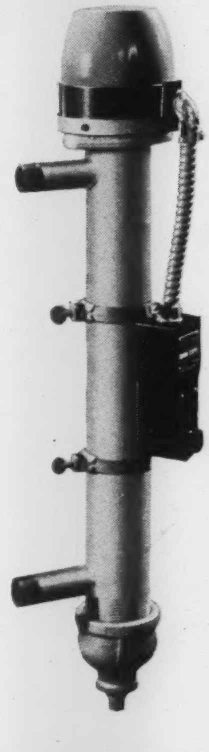
A simple electric heater for water or oil



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Automatic temperature control is provided by an adjustable clamp-on thermostat (for water) or a thermostat inserted through the drain hole (for oil).

Furnished in capacities from 1 Kw. up to 15 Kw., and with or without insulated jacket and 3-heat switch. Where particularly high capacity is required, two or more heaters can be mounted in series on the circulating line.

Chromalox electric heating units in a broad range of types, are available from stock for most industrial requirements.

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other powdered materials, which has broadened the field of metallizing surfaces to protect them against corrosion.

No. 2902. NOISE MEASUREMENT: B. F. Sturtevant Co., Damon St., Hyde Park, Boston, Mass. 8 p. bulletin (407-1) presenting a valuable discussion of noise measurement by H. F. Hagen. Fundamental basis of noise measurement is explained clearly, the three reference levels are compared, and examples of noise specifications and noise computations are included.

No. 2903. OIL BURNER NOZZLES: Balloffet Dies and Nozzle Co., Inc., 45-51 Adams St., Guttenberg, N. J. 4 p. bulletin on steel oil burner nozzles, with information on features, a capacity table and other pertinent data.

No. 2904. PIPE HANGERS AND SUPPORTS: Grinnell Co., Inc., 260 W. Exchange, Providence, R. I. Reference chart for desk use of engineers and purchasing agents, featuring complete line of adjustable pipe hangers and supports. Each style is illustrated and the figure number is given.

No. 2905. PROCESS CONTROL: Bristol Co., Platts Bridge, Waterbury, Conn. Bulletin (511) illustrating installations using the manufacturer's system of coordinated process control. What it is and what it will do in automatically controlling complete manufacturing processes is described.

No. 2906. PUMPS: Decatur Pump Co., 2750 Nelson Park Rd., Decatur, Ill. 8 p. bulletin (115) on "Burks" straight and self-priming semi-industrial pumps, including descriptions of features, and capacity and performance tables. Also 16 p. bulletin (40-60) on shallow and deep well water systems.

No. 2907. REFRACTORY PRODUCTS FOR STOKER INSTALLATIONS: Johns-Manville, 22 E. 40th St., New York, N. Y. Pamphlet (RC-12A) describing refractory products for stoker installations, including castable refractories for building hearths and lining doors, a cement for bonding fire brick and for wash coating, and asbestos furnace cement for sealing joints against gas leakage and air infiltration.

No. 2908. SHUTTERS AND DAMPERS: Elgo Shutter & Mfg. Co., 634 W. Warren Ave., Detroit, Mich. 4 p. bulletin describing shutters and dampers for ventilating installations, giving list prices.

No. 2909. SOLDERING IRON STANDS: Electric Soldering Iron Co., Inc., Deep River, Conn. Leaflet describing thermostatic control stand for maintaining constant uniform temperature of electric soldering irons when they are lying idle between soldering operations.

No. 2910. SPRINKLER SUPERVISORY SERVICE: American District Telegraph Co., 155 Sixth Ave., New York, N. Y. 28 p. booklet on "Backing up the Sprinkler" explaining how the hazard of human failure can be eliminated by backing up the sprinkler system with automatic electrical supervision which detects and reports trouble conditions to secure immediate corrective action. Several cases indicating the need for such supervision are presented and the "A.D.T." sprinkler supervisory and water flow alarm service is described in detail with diagrams and illustrations of the equipment. Also, a leaflet describing heating system supervision for detecting automatically abnormal or subnormal conditions and reporting them for immediate corrective action.

No. 2911. STAINLESS STEEL VALVES AND FITTINGS: Alloy Steel Products Co., 1000 W. Elizabeth Ave., Linden, N. J. Looseleaf catalog on "Aloyco" stainless steel valves and fittings giving a complete list of the standard alloys obtainable, illustrations and descriptions of the various types, and data on applications.

No. 2912. STEAM SPECIALTIES: International Nickel Co., Inc., 67 Wall St., New York, N. Y. 8 p. booklet entitled

INDEPENDENT "Fabrikated" REG. U.S. PAT. OFF.

adjustable

DIRECTED AIR FLOW

REGISTERS *and* GRILLES

Each grille bar can be set individually to direct air flows right or left or up or down, either at the time of installing, or after the system is in operation.

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"Non-Clogging": Fig. 629 and Fig. 631 (female) produce a fine, soft, evenly distributed spray. Contain no internal parts or slots to wear or clog. Capacities from 4.0 g.p.h. up.

"Perfection": Fig. H-261 and F-27 (female) are made in capacities from .57 g.p.h. up.

CATALOG 6-A

MONARCH MFG. WKS., INC.
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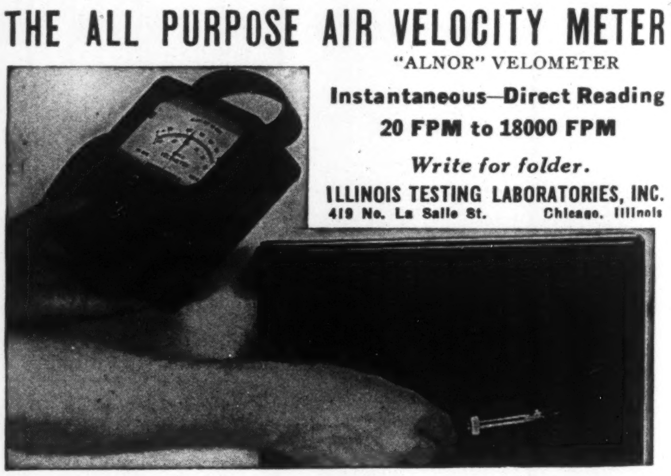
1/4" Fig. 629
1/4" Fig. H-261



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Instantaneous—Direct Reading
20 FPM to 18000 FPM

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Stop VIBRATION NOISE

in Compressor Lines

Rex Vibra-Sorbers absorb vibration, stop noise, insure permanently quiet operation. Sweated into the compressor lines, they act as flexible couplings for speedy, trouble-free installation. All sizes available.

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Made by
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BEACON UNIT HEATERS

Highly efficient in Performance, the new streamlined Beacon Heaters meet every Industrial and Architectural requirement for units that will harmonize with any interior.

The line embraces a wide range of sizes in capacities from 20,850 Btu to 318,000 Btu, for steam pressures up to 200 lbs.

Entire heating element is of seamless copper without bolts or gaskets, thus all joints are eliminated and the greatest possible transfer of heat assured. Tubes are expanded into fins without solder and have orifice at inlet providing more efficient steam distribution.

Write today for detailed description and general specifications.

A few desirable territories still
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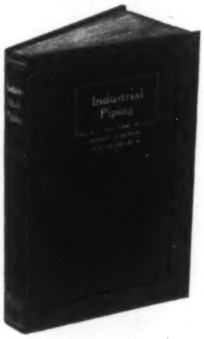
Write for franchise details.

BEACON-MORRIS CORPORATION
702 Beacon Street, Boston, Massachusetts

Only $1.00 for This Valuable 285-Page Book on Piping!



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Here is a book that will add the equivalent of years of actual practice to your knowledge of every phase of piping work. From beginning to end it is filled with practical data and kinks on piping design, layout, construction, operation, and maintenance contributed from their experience by nineteen well-known piping engineers. They present to you in this book methods, tables, formulas, and other valuable piping data that it has taken them many years in piping work to develop and perfect. Further, they show you exactly how they have used these methods and data in eliminating faults on existing piping services, and in saving time and expense in the layout and installation of new ones.

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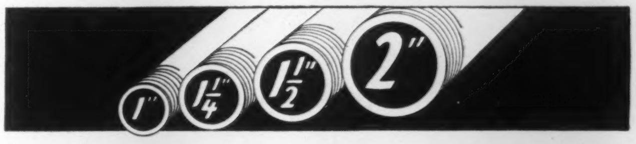

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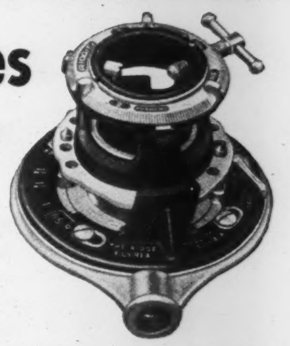

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Only 4 chaser dies instead of 16—and they stay in the threader. No bother changing, no extra pieces to lose. Saves you time and expense! Just a quick shift of the setting post and this No. 65R is ready to cut perfect threads on 1" to 2" pipe, any metal, all thread variations. Saves you work! Speedy new style work-holder clicks to pipe size, tightens with one screw. No bother with bushings! You like the "feel" of this tool, the handsome appearance that inspires pride and care, the many features that give you faster easier threading—and real economy, as thousands of users can tell you.

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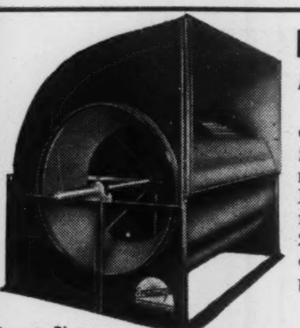

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Two sides to THIS machine—use one for Locks, other for Cleats. One set of rolls can handle all gauges, 18 to 28. Change rolls in 20 min. Central all-gear drive. Quick, accurate roll adjustment. Save up to 90% of labor cost in making Pittsburgh Locks and Drive Cleats.

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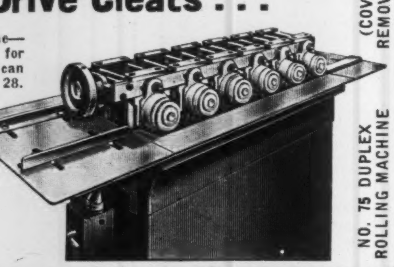

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WHITNEY METAL TOOL CO., 180 Forbes Street, Rockford, Illinois

Do you know ANY other Duct Insulation that equals this in EFFICIENCY plus PRACTICALITY?

• Thermal Conductivity only 0.246 B. T. U.'s! . . . Permanent . . . fire and moisture resistant . . . won't rot or decay . . . repels vermin . . . shapes perfectly to ducts . . . easy to apply.

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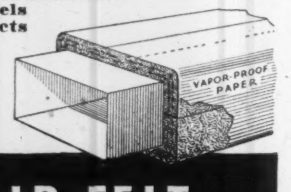

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"The Third Essential in Steam Specialties" featuring the use of "Monel" in meters, regulators, thermometers and other steam specialties.

No. 2913. STEAM TURBINES: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 12 p. booklet on general purpose steam turbines with capacities ranging from 5 to 500 hp at turbine speeds of 1000 to 5000 rpm. The points to check when selecting a turbine in order to insure continuous service, economy and safety are discussed.

No. 2914. STEEL BOILERS: Kewanee Boiler Corp., Kewanee, Ill. 24 p. general catalog (80e) covering the full line of the manufacturer's steel boilers, giving complete specification data and measurements on every size and all models. In addition to 18 pages of data on fire box riveted boilers in the updraft and smokeless type, and "Type C" welded boilers for hand fired coal and for oil, gas or stoker firing, this catalog devotes three pages to the square and round type residence boilers and two pages to "Tabasco" water heaters, water heating garbage burners and tanks.

No. 2915. SURFACE CONDENSERS: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 24 p. booklet on radial flow surface condensers, describing basic principles, construction and operation, and with charts for calculating size of condenser and amount of circulating water required for a given duty.

No. 2916. SYNCHRONOUS MOTOR CONTROLLERS: General Electric Co., 1 River Rd., Schenectady, N. Y. 12 p. bulletin (GEA-1724A) on controllers for synchronous motors, describing construction and explaining operation of the manufacturer's complete line.

No. 2917. VACUUM COOLING: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 6 p. leaflet (F. 8445) on steam jet vacuum cooling for either continuous or batch cooling within a range from 35 to 65 F.

No. 2918. WASHERS: Wrought Washer Mfg. Co., 2100 S. Bay St., Milwaukee, Wis. New stock list (55-B) of thousands of washer specifications in various materials including steel, brass, copper, aluminum, fiber, etc., carried in inventory available for immediate shipment.

No. 2919. WELDER CONTROLS: General Electric Co., 1 River Rd., Schenectady, N. Y. 8 p. bulletin (GEA-2791A) on "Thyratron" resistance welder controls.

No. 2920. WELDERS: Hobart Brothers, Hobart Square, Troy, Ohio. 24 p. catalog on "Multi-Range" arc welders, giving complete descriptions of features, and construction and tabular data.

No. 2921. WELDING: International Nickel Co., Inc., 67 Wall St., New York, N. Y. 4 p. bulletin on welding "Monel," nickel and "Inconel" with a table of recommended rods and fluxes for use with these metals.

"NOW our Factory Workers Are *Comfortable* All Winter

Buffalo Suspended-type Unit Heater recently installed in one of the nation's large rubber factories.

Thanks to "Buffalo" UNIT HEATERS"

It's almost unbelievable, the difference Buffalo Unit Heaters can make in keeping factories at right working temperatures. Highly efficient, they distribute the warm air over a wide area. There are no hot spots and no cold spots. You get the most from every heating dollar—every pound of steam.

Buffalo Unit Heaters are available in many styles and sizes, including gas unit heaters, to meet every heating requirement. Whatever heating or modernization work you may be planning, it will pay you to secure all the facts on Buffalo Unit Heaters. They are contained in complete and concise form in our Bulletin 3050. Why not write for it today?

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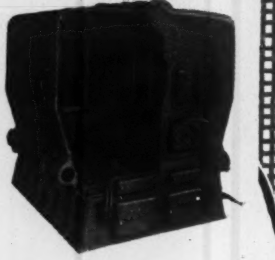


The Twin Sectional Cast Iron. Made in 9 sizes. Rates from 7,850 to 19,450 sq. ft. of E.D.R. Steam Rating. Water from 12,000 to 31,800 sq. ft.

Hank Sez:—

"What's the Use of Raring and Tearing Around When There Ain't No Use?"

T'other day I saw a heck of a big hole busted plumb out the side of as fine a building as you could set your eyes on. Being a sort of wanting-to-know kind of a feller, asked why the hole?

Well 'twas like this—the Steel Boiler what wuz doing duty quit a doing it.

So they wuz yanking it out by its suspenders and putting a Burnham Twin Section one in its place.

Course I wuz no wise upset at its being a Burnham. But somehow couldn't help a wondering why they busted that hole?

Why couldn't they just have shoved the worn out Steel Boiler to one side, and then took the Burnham sections and base parts right thru any of their doorways, what wuz big enough fur a man to come thru without knocking off his mud guards.

Saying which, you might think I sort of had it in fur Steel Boilers. But you're wrong.

We make Steel Boilers, well as Cast Iron, and one is as good as the other and no better.

Burnham's are built to a reputation and a specification. Some makes of boilers only has the specifications which ain't enough fur engineering fellers like you.

Hank Hindle

Burnham Boiler Corporation

Manufacturers of Heating Equipment Since 1873

IRVINGTON, NEW YORK   ZANESVILLE, OHIO

Export Department:

50 Church Street, N. Y. City

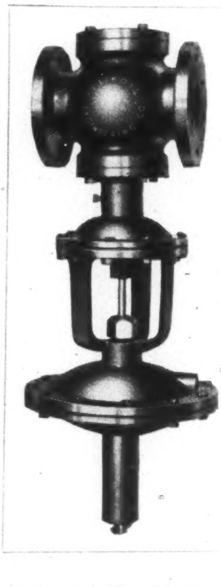
Burnham Boiler

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 126. Add the new products and companies listed here to your Directory Section which you received in your January, 1938, HEATING, PIPING AND AIR CONDITIONING and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

New Valves for Heating System Control

No. 1518—Several valves for use with the manufacturer's "selective pressure" heating systems have been announced. The principle of the system involves utilization of the wide temperature variation of steam obtained by varying the steam pressure. In addition, whenever outdoor temperature is so high that a continuous supply of steam even at a low temperature-pressure level would tend to overheat, intermittent shots of low temperature steam are sent to the radiators as frequently as required. According to the manufacturer, steam utilized in this way gives unrestricted and unsurpassed rapidity of circulation, prevents any back circulation of steam to radiators where they are shut off, and is flexible and responsive to any change in room temperature.



The type "M" valve is a manual control valve operated by wheel adjustment and provided with indicator and adjustable calibrated scale.

The type "I" is a fully automatic motorized flow control valve with a reversible type valve motor and operated by a special thermostat responsive to space temperature. This thermostat causes the valve to operate first in one direction and then in the opposite direction in ½ minute cycles varying the running period of the motor in each direction during each cycle. The type "L" is a semi-automatic motorized valve similar to it but operated manually from a remote control cabinet. These three valves are unique, says the maker, in that they are full floating, minimizing wear due to constant readjustment upon slight loading changes and they can also be either manually or automatically fully opened or fully closed.

The type "A" valve (illustrated) is pneumatically operated and has two diaphragms, one subject to the reduced outlet or heating system pressure and the other to the compressed air loading. The primary setting for minimum heat requirements is controlled by a spring.—Illinois Engineering Co., 2035 S. Racine Ave., Chicago, Ill.

New Stoker Line Has 19 Models

No. 1519 — "Precision manufacture" features a new line of stokers comprising 19 models ranging in size from 20 to 1200 lb per hr. There are eight heavy duty stokers for commercial and industrial applications as well as models for small commercial and residential applications.

Features of construction as announced by the manufacturer include "free rolling" automotive type transmission, scientifically designed retorts, straight flight feed screws which require less power to turn, use of rust resisting copper bearing steel for all parts subject to corrosion from contact with the coal, high capacity paddle type fans providing ample pressure to penetrate

A DIALOGUE THAT ADVERTISERS WOULD DO WELL TO OVERHEAR
"My salesmen want *more* advertising!"

. . . chortled the Sales Mgr. to the Adv. Mgr.

"Don't faint, Al. I know it sounds strange for my men to say they want more advertising. But they do. Not a bigger total budget, but a bigger chunk of our advertising dollar used to help 'em get our story to the Heating, Piping & Air Conditioning field . . . more ads in HEATING, PIPING & AIR CONDITIONING.

"You and I have had plenty of battles. But today, when the management is after me to get more sales at less cost, I'm going to need all the help that advertising can give my men.

"You've told me how HEATING, PIPING & AIR CONDITIONING covers the market we have to sell . . . how it does a swell editorial job—and how we know it is read because its readers pay subscription cash for it. Those readers are my gang's prospects and since it costs less than the price of a cheap cigar per prospect to reach them, let's "hype up" our schedule in HEATING, PIPING & AIR CONDITIONING. Let's cultivate the men that my men have to sell."

"All I can say," muttered Ad. Manager Al, "is that the old order changeth when a hard-boiled sales manager like you learns to appreciate the media worth of a strong business paper like HEATING, PIPING & AIR CONDITIONING.

Highest editorial standards and publishing integrity.

ABP

HEATING, PIPING & AIR CONDITIONING

bears the twin hall-marks of known value

ABC

Proved reader interest in terms of paid circulation.

APARTMENT BUILDING SAVES 75 TONS OF COAL IN 4 MONTHS

Webster Moderator System Helps Windsor Court Apartments to Improve Heating Service

BETTER STEAM DISTRIBUTION

Weekly Heating Schedule of 112 Hours Increases Importance of Effective Heating

TENANTS GET ADDED COMFORT

Baltimore, Md.—With a heating schedule of 112 hours a week for average winter weather, the Windsor Court Apartments made an appreciable reduction in heating costs by installing a Webster Moderator System of Steam Heating.

During the first four months of the 1937-38 heating season, coal consumption was reduced 75 tons. This savings figure is based on the average coal consumption for the two years preceding modernization, with correction for degree day differences. After this practical demonstration of the efficiency of the Webster Moderator System, the owners of the apartment exercised their contract option and completed payment for cash.

Windsor Court Apartments, Baltimore, Md.

W. Burton Guy, Manager of the Windsor Court Apartment Corporation, said: "In past years our coal consumption has been 373 tons average per year. In the first four months with the Webster Moderator System, we used 75 tons less than the average. We believe that our total for the year will be well over 100 tons savings.

"We get greater comfort, more even distribution of heat, with less complaints," Mr. Guy said. "To accomplish the savings it is not necessary to starve the tenants of heat. We are pleased with the results and know our investment will be returned in less than three years."

Comfort for tenants, an important consideration in apartment house management, is accomplished with an Outdoor Thermostat which automatically adjusts the basic rate of steam delivery with every change in weather conditions.

Lloyd E. Mitchell, Inc., well-known Baltimore heating firm, served as modernization heating contractors. There is a total of 6.795 square feet of installed direct radiation.

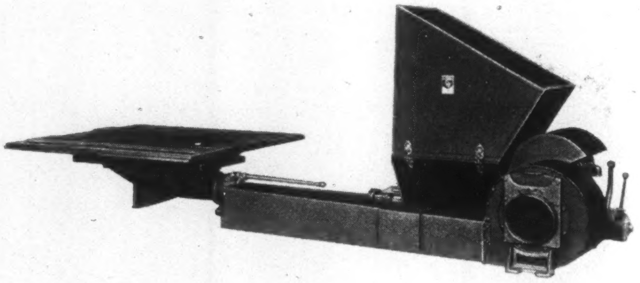
These before-and-after facts point the way to maximum comfort and economy in heating new buildings as well as in modernization of existing installations. Consult your architect, engineer or heating contractor. Or address

WEBSTER MODERATOR CONTROL
"Control by the weather"

1888 WARREN WEBSTER & CO., CAMDEN, N. J. 1938
Pioneers of Modern Steam Heating
50 YEARS OF HEATING PROGRESS
Representatives in 60 principal U. S. Cities

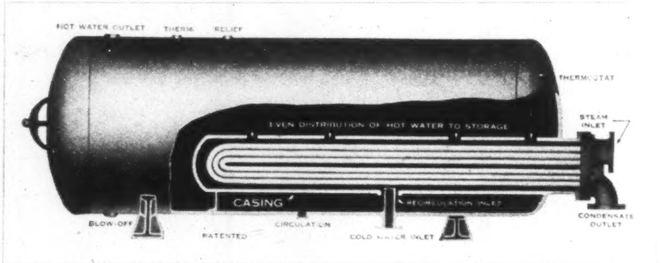
the deepest fuel beds, and a large removable shearing plate whic permits quick removal of foreign material in the coal.

A patented electric safety shear pin switch stops both mot and fan if any obstructions stop the flow of coal; according t the maker, by stopping both motor and fan, the fire lies dormant and damage from a complete heat shut down is avoided. The patented "Marvel" air volume control automatically supplies the correct amount of air to the fire bed for efficient combustion.—Econ-O-Col Stoker Div., Cotta Transmission Corp., 2340 11th St., Rockford, Ill.



Storage Heaters Employ New Principle

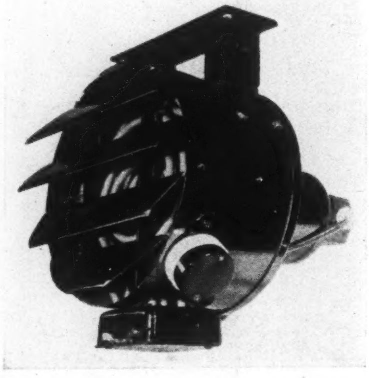
No. 1520—Design of the new "Super-Service" storage heaters provides for intimate contact of all of the water with all of the heating surface at all times, according to the manufacturer. This is made possible because the entering water passes directly into the bottom of a casing completely enclosing the heating element. Outflow openings at the top of the casing are proportioned and located so that the flow of the water before passing to storage is distributed over the entire heating surface. The water inlet opening at the bottom of the casing is also proportioned to cause recirculation of storage water at all times, whether water is being drawn or not.

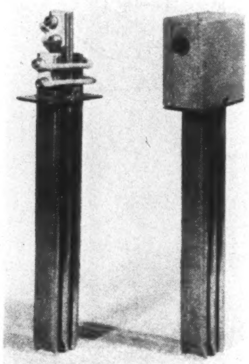


This type of design has been employed to prevent some of the water passing between the heating element and shell without coming in contact with the heating surface.—National Pipe Bending Co., 122 River St., New Haven, Conn.

New Electric Heating Units

No. 1521—Illustrated is a modification of the manufacturer's standard electric unit heater, the unique features of which con-





sist of, first, an adjustable angle hanger and, second, independent adjustable louvers to a round unit heater. The rating is 5 kw at 230 volts, single or three phase.

The other illustration shows a recently developed three blade immersion unit with metal terminal cap. Rating is 3 kw at 115 volts and the heating length is 11 in. The base is rectangular.—Harold E. Trent Co., 618-640 N. 54th St., Philadelphia, Pa.

Magnetic Contactors for Small Motors

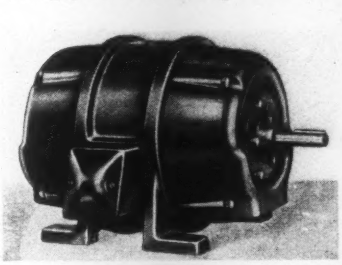
No. 1522—New N.E.M.A. size 0 a-c magnetic contactors for small continuous duty single and polyphase motors have recently been placed on the market. Long life of the silver-to-silver butt type contacts is guaranteed by the maker because their "twin-break" function reduces the arc and operation, and a restricted pocket cools it.

The N.E.M.A. type 1 enclosure is "air styled" and is compact, measuring only 4⅞ x 7⅞ x 4 in. It has a hook-on cover removable by loosening one screw, and an aluminum finished interior for better vision.

Available in 2, 3 and 4 pole constructions with maximum ratings of 1½ hp for single and 2 hp for polyphase, the units can also be secured in skeleton form for built-in use.—Cutler-Hammer, Inc., N. 12th St. & W. St. Paul Ave., Milwaukee, Wis.

New Splashproof Motors Announced

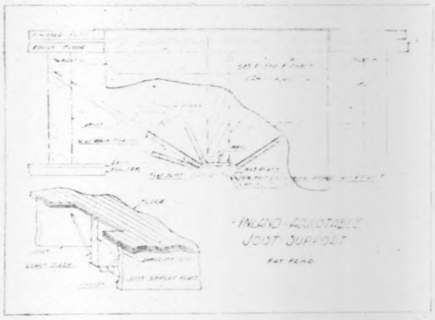
No. 1523—Distinctive features of design which characterize a new line of splashproof motors are—according to the maker—sturdy cast iron construction, especially impregnated windings, an effective baffling system to prevent the entrance of water or falling particles, an improved system of ventilating to assure low temperature rise, and sealed ball bearings accessible for lubrication in all mounting positions.



The motors conform to N.E.M.A. specifications for splashproof motors and are furnished in all N.E.M.A. sizes and ratings.—Diehl Mfg. Co., Trumbull St., Elizabethport, N. J.

Adjustable Joist Support Offered

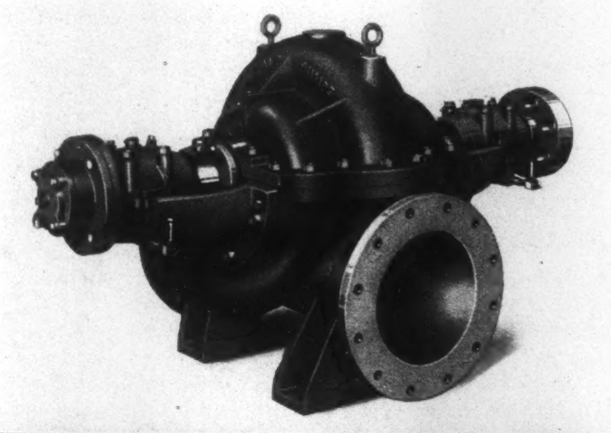
No. 1524—A new adjustable joist support has been designed to do away with the job of fitting headers on floor joists where existing floor structure must be cut for installation of duct work, piping, etc. According to the maker, it provides a strong rigid reinforcement for sawed or weakened joists.



It is adjustable to fit all sizes of floor joists on centers up to 18 in.; the weight on load or partition bearing joists can be distributed to adjoining joists; the joists are supported before cutting to prevent any lowering.

In installing the device the joist plate is fastened with one nail to the bottom of the joist to be cut, a pilot hole is drilled in each adjoining joist with a long wood drill, and the coach screws are turned in

CAPACITIES *from* 10 *to* 10,000 G.P.M. *and*



"Buffalo" PUMPS

used where Performance Counts

PERFORMANCE GUARANTEED!

We could tell you all about the details of Buffalo Pump construction, but when all is said and done "It's Performance that Counts."

When you buy a pump, that's what you want, and that's what you will get if it bears the name "Buffalo."

Just tell us

What Liquid?
What Quantity?
What Head?

Then leave it to Buffalo engineers to supply you the pumps that best suit your needs—pumps that will render many years of touble-free service at low power costs.

That's the best way to get top value from your pump investment.

BUFFALO PUMPS, INC.
171 Mortimer St. Buffalo, N. Y.
Branch Engineering Offices in Principal Cities
In Canada: Canada Pumps, Ltd., Kitchener, Ont.

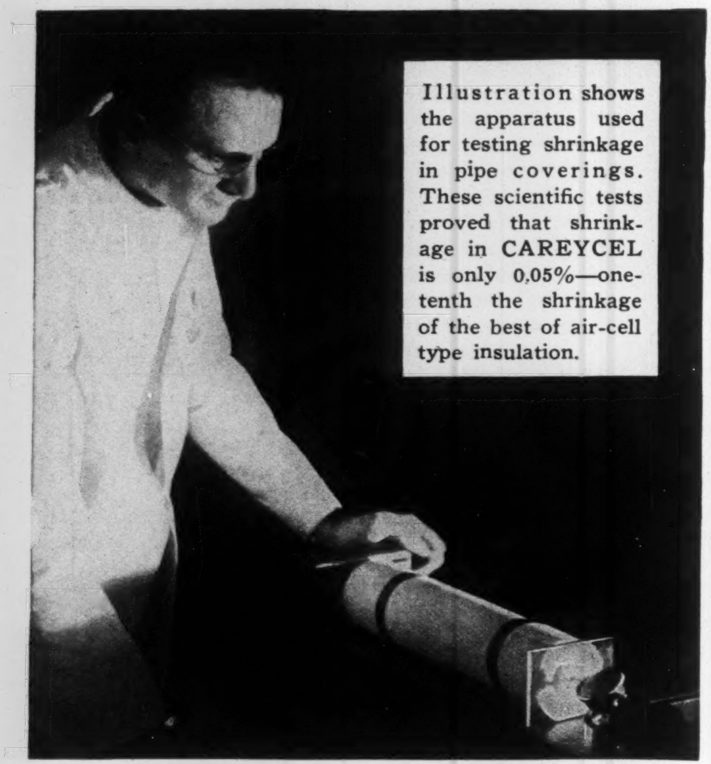


Illustration shows the apparatus used for testing shrinkage in pipe coverings. These scientific tests proved that shrinkage in CAREYCEL is only 0,05%—one-tenth the shrinkage of the best of air-cell type insulation.

The Master Insulation for Heating Systems...

Careycel
ASBESTOS INSULATION

Consider these advantages of CAREYCEL over air-cell insulations when figuring future jobs:

ABOVE-CAREYCEL CONSTRUCTION
BELOW-AIRCELL CONSTRUCTION

The cross-sectional illustration below shows the smallness of air spaces in Careycel as compared with ordinary air cell. This is the principal reason for its higher efficiency and is made possible by the exclusive Carey process of "cellizing" the asbestos sheets.

CUTS HEAT LOSS 30%

Impartial tests at Mellon Institute conclusively demonstrated that heat loss through CAREYCEL is 30% less than through an equal thickness of ordinary air-cell.

MINIMUM SHRINKAGE

Shrinkage is negligible. Eliminates unsightly, heat-wasting cracks at joints.

BETTER APPEARANCE

CAREYCEL provides a smooth, even, symmetrical surface—gives a more finished, workmanlike appearance.

Although CAREYCEL has these distinctive, outstanding advantages, it sells in the same price range as air-cell.

Satisfy customers—build business—increase profits with CAREYCEL. Samples and positive proof of CAREYCEL superiorities sent on request. See nearest Carey Distributor, or write. Address Dept. 25.

THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
BRANCHES IN PRINCIPAL CITIES

and the washers and nuts applied.—Inland Mfg. Co., 1120 N. Cicero Ave., Chicago, Ill.

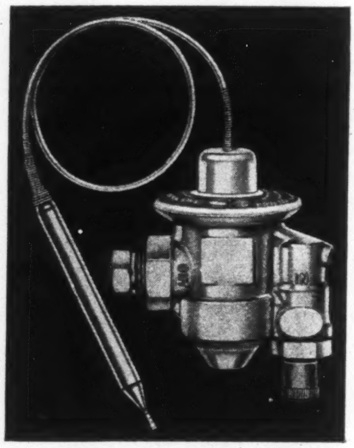
Portable Room Cooler Announced

No. 1525—The "Master Kraft" room cooler is offered by the maker particularly for use in small stores, offices, beauty parlors, hospitals, hotels and residences and is arranged for installation under a window to take in outside air. Capacity is 5,000 Btu, "Freon" being used as the refrigerant.

A novel feature is that the unit supplies cold drinking water. While it is an air cooled unit with no water connections necessary, it incorporates a water cooling container which if connected to tap water or to bottled water, allows cold drinking water to be drawn from a tap at the side of the cabinet.—Harvey-Whipple Inc., Springfield, Mass.

New Expansion Valves Announced

No. 1526—Two new products just announced are an automatic expansion valve for "Freon," methyl chloride and sulphur dioxide, and a new thermostatic expansion valve.



The automatic expansion valve has a ¼ ton rating on "Freon" and a ½ ton rating on the other two refrigerants, and has an adjustable range of 20 in. vacuum to 30 lb pressure. Features are, according to the maker, special alloy diaphragm, forged brass electro-tin plated body, self aligning stellite needle, large strainer, breathe-proof rubber cap, and non-chattering construction.

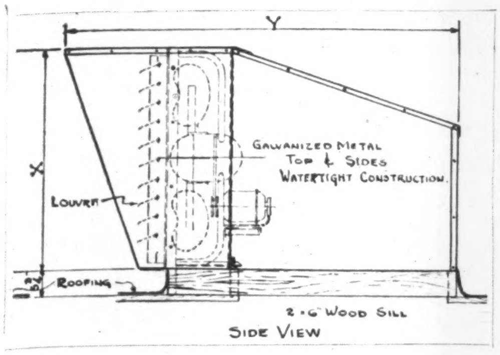
The thermostatic valve is furnished in two orifice sizes, giving a ¼ hp capacity on "Freon" and a ⅓ hp capacity on methyl chloride or sulphur dioxide. The factory-set superheat is 10 deg with an available range from 5 to 15 deg. It is similar in construction to the automatic valve except that it is controlled by a thermostatic bulb.

Particular features are small body size, short capillary, small ⅜ in. bulb, and its liquid charge feature which makes it possible to install the valve in a temperature either higher or lower than the bulb temperature.—Automatic Products Co., 2450 N. 32nd St., Milwaukee, Wis.

Roof Ventilator is Offered

No. 1527—The new roof ventilator diagrammed combines an exhaust fan and automatic shutter in a weathertight penthouse constructed of "Armco" galvanized iron. The sloping top of the penthouse and ample space between its back side and the fan unit permits a large volume of air to be drawn through without turbulence and with minimum resistance, according to the maker. The extended part or cowl effect in front of the shutter enables the fan to be operated in rainy weather.

The commercial exhaust fan used in the ventilator is furnished

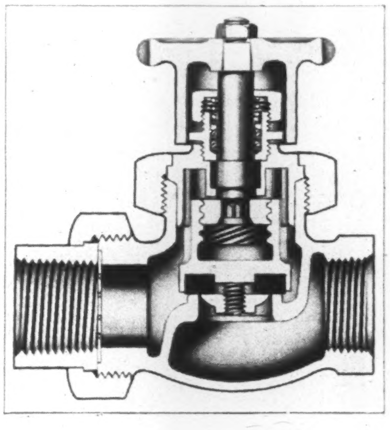


as standard equipment with totally enclosed motor not affected by greasy fumes or damp weather. A streamline hub and pulley arrangement is used to assure high air delivery and protect the bearing from dust and dirt.

Three sizes are available with fan diameters of 32, 40 and 48 in.; ⅓, ½ and ¾ hp motor size; and 7500, 11,500, and 16,500 cfm air delivery, respectively.—Viking Air Conditioning Corp., Main and Center St., N.W., Cleveland, Ohio.

New Air Pump Unions and Valves

No. 1528—A new line of forged steel air pump unions constructed for high pressure lines subject to piping strains and vibration, expansion and contraction, such as locomotive service, conform to the specifications and recommended practice of the Association of American Railroads for 300 lb air pump unions. They are recommended for 600 lb steam working pressure at 550 F, and for 2000 lb cold water, oil or gas, non-shock.



The same manufacturer has also designed a new, brass, globe valve for air installations where quick opening, quick closing valves are needed, especially in mines on air lines leading to pneumatic hammers. Among its features are an apron on the wheel to protect the upper part of the valve from rough handling and a brass screen in the union connection at the valve inlet to keep out foreign matter. It is made in ¾ and 1 in. sizes and is recommended for 150 lb air working pressure. The composition disc can be quickly and easily renewed when necessary, according to the manufacturer. A spring maintains a constant load on the stuffing box packing.—Crane Co., 836 S. Michigan Ave., Chicago, Ill.

Device Determines Carbon Monoxide

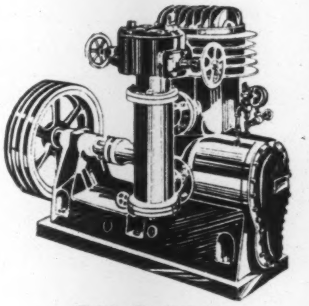
No. 1529—A new device for ascertaining the carbon monoxide content of any given air space has been perfected and will be made available within a short time.

According to J. B. Ficklen, the inventor of this device, the new detector permits tests to be made at greatly reduced cost. The simplicity of its construction, furthermore, is such that it can be operated by persons having limited knowledge of testing technique. The method depends upon the conversion of carbon monoxide into carbon dioxide by combustion and the reaction of this carbon dioxide with an earth-alkali hydroxide, using phenolphthalein as an indicator. By means of an ordinary bicycle pump, the atmosphere to be tested is drawn through a filter, removing all carbon dioxide and hydrocarbons from the air. The carbon monoxide, remaining unchanged, is then converted to carbon dioxide by drawing it over an ordinary cigarette lighter coil. The product is then bubbled through the alkali

Sales naturally increase with FRICK Air Conditioning

As proved by the records of well-known stores equipped with Frick Refrigeration throughout the country including:

Sattler's, Inc., Buffalo
Woolf Brothers, Kansas City
J. C. Penney Co., St. Joseph
Sonnenfeld's, St. Louis
A. Harris & Co., Dallas
E. M. Kahn & Company, Dallas
The Wolff & Marx Co., San Antonio
Hochschild, Kohn & Co., Baltimore
Sears, Roebuck & Co., Washington
Murphy's 5 and 10c Stores, Washington, Harrisburg and Pittsburgh



Frick Enclosed Freon Compressor

What are your cooling needs? Whether for air conditioning, cooling drinking water, food service, making ice or storing flowers, furs, etc., there's a Frick plant of the size and type that will make money for you.

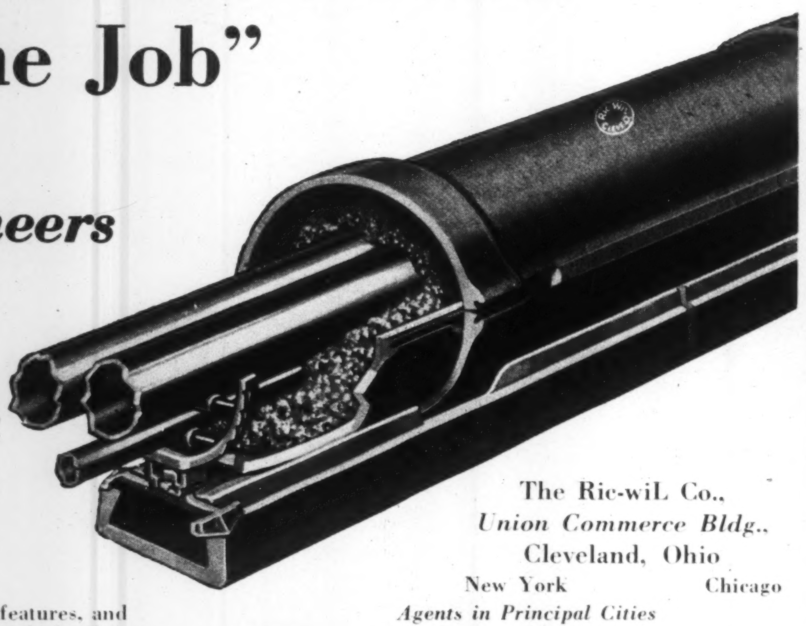
Over 35,000 users. Ask for a survey and estimate now.

FRICK Co.
WAYNESBORO, PENNA. U.S.A.
DEPENDABLE REFRIGERATION SINCE 1882

"Only RIC-WIL Conduit Will Do the Job"

say scores of Heating Engineers

- **Keeps steam lines tight and dry!**
- **Rigid interlocking construction at all points!**
- **Unique non-deteriorating Dry-paC Insulation — in a class by itself!**



Investigate the materials, construction features, and actual service record of any Underground Conduit *before* you buy! Ric-wiL far outsells *any* other system. The thoroughly demonstrated, economical method of keeping *your* underground steam lines tight, dry, and over 90% efficient is to house them in a Ric-wiL Tile or Cast Iron System, insulated with famous Ric-wiL Waterproof Asbestos Dry-paC. Competent service, nation-wide, on design, manufacture and installation. Write for Catalog showing all types.

The Ric-wiL Co.,
Union Commerce Bldg.,
Cleveland, Ohio
New York Chicago
Agents in Principal Cities

REGISTERED IN U. S. PATENT OFFICE

RIC-WIL

CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

Custom Built MOTORS

For Your Specific Needs

The HOLTZER-CABOT Electric Co.

CHICAGO · NEW YORK BOSTON MASS. PHILADELPHIA

solution. With the capacity of the pump known, it is only necessary to count the number of strokes until the color of the solution disappears. By referring to a table computed on the basis of carbon monoxide concentrations that are negligible, slightly harmful, and dangerous, with finer gradations between these divisions, the amount of carbon monoxide in the tested atmosphere is ascertained to a degree of accuracy sufficient for all practical purposes.

Specifications and instructions will be made available to anyone interested in promoting safety and the welfare of those who might be exposed to poisoning by carbon monoxide.—Travelers Insurance Co., Hartford, Conn.

Compact Smokehouse for Meat-Packers

No. 1530—A compact "all-in-one" smokehouse for curing meats includes the air conditioning functions of temperature control, humidity control and air circulation. In addition the smoke is filtered before it pours into the house, eliminating possibility of soot sticking to the meat and causing "green spots."

One of the principal features of the smokehouse is its compactness. The entire unit, constructed of galvanized iron, may be set up on one corner of the space ordinarily used in smoking, the maker states. It comes equipped with a smoke generator, a heat diffuser, which controls heat and air circulation, humidity control equipment, and automatic controls.—Carrier Corp., Syracuse, N. Y.

Copper Tube for Sprinkler Branch Lines

No. 1531—Use of hard drawn, copper water tube in the fabrication of automatic sprinkler branch lines has been approved by Underwriters' Laboratories, Inc. The types and sizes of the pipe tested included the manufacturer's "Government Types K, L and M" in sizes of from ¼ in. to 2 in., from ¾ in. to 2 in., and from 1¼ in. to 2 in., respectively.

The tested copper water tube was recommended "for use with listed solder joint type fittings (tested and accepted with the pipe) in the fabrication of branch lines, trim of alarm and dry pipe valves, supply and heater connections to gravity tanks, bell line piping and other similar piping of automatic sprinkler equipment where working pressures do not exceed 175 lb per sq in."—Bridgeport Brass Co., E. Main St., Bridgeport, Conn.

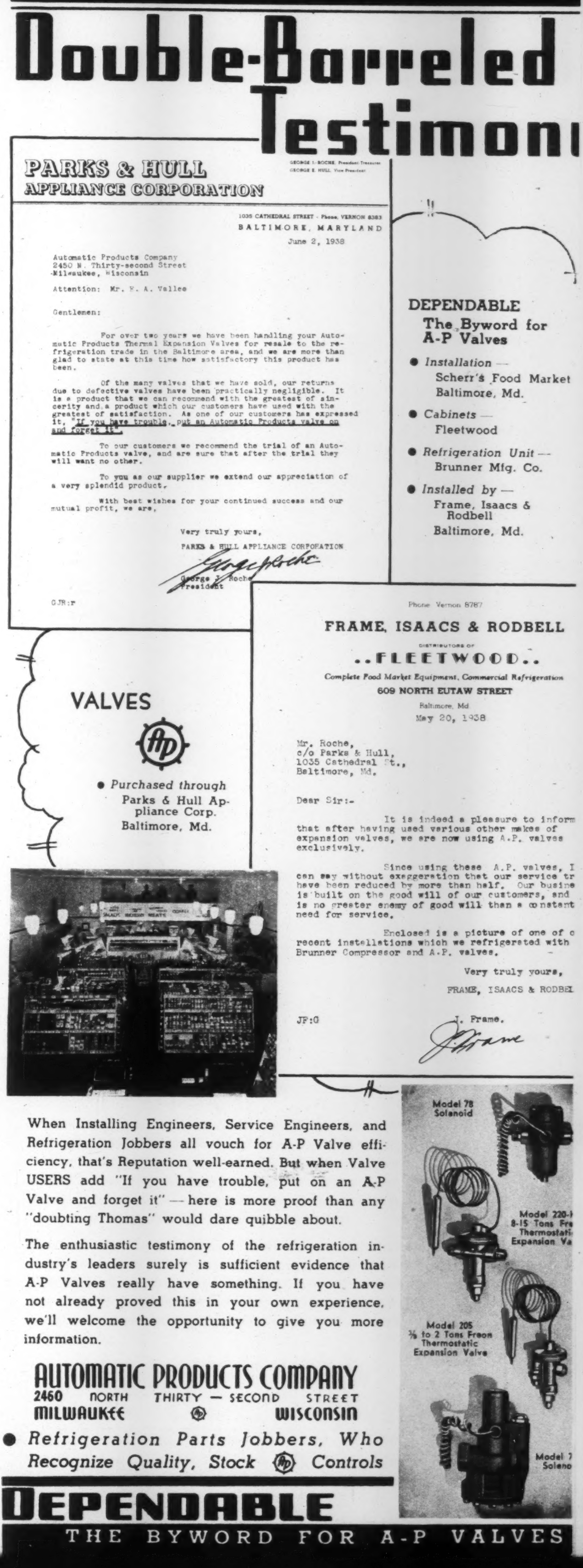
Clock Switch for Day-Night Temperature Control

No. 1532—The new synchronous self-starting electric clock switch illustrated is especially suited for day-night temperature control applications. By means of the instrument, in conjunction with thermostats and effective temperature control instruments, automatic night time temperature setback is provided with consequent savings and convenience to users.

This clock switch may be located either with the thermostat or other control instrument concerned or in some remote location. The clock motor operates on 20 volts from a small transformer supplied with the clock, which in turn is supplied with the 110 or 220 volt electric line.—Julien P. Friez & Sons, Inc., 4 N. Central Ave., Baltimore, Md.

One Gage Does Work of Two

No. 1533—The new "Hi-Lo" single gage charging and testing unit for air conditioning and refrigeration work will, when connected to both sides of the system, give pressure readings of both the high and low sides with a single gage and single valve. Other advantages are (according to the maker) that it permits bypassing at any time without capping the charging and purging



Double-Barreled Testimoni

PARKS & HULL
APPLIANCE CORPORATION

GEORGE L. ROCHE, President-Treasurer
GEORGE E. HULL, Vice President

1035 CATHEDRAL STREET - Phone, VERNON 8383
BALTIMORE, MARYLAND

June 2, 1938

Automatic Products Company
2450 N. Thirty-second Street
Milwaukee, Wisconsin

Attention: Mr. E. A. Vallee

Gentlemen:

For over two years we have been handling your Automatic Products Thermal Expansion Valves for resale to the refrigeration trade in the Baltimore area, and we are more than glad to state at this time how satisfactory this product has been.

Of the many valves that we have sold, our returns due to defective valves have been practically negligible. It is a product that we can recommend with the greatest of sincerity and a product which our customers have used with the greatest of satisfaction. As one of our customers has expressed it, "If you have trouble, put an Automatic Products valve on and forget it".

To our customers we recommend the trial of an Automatic Products valve, and are sure that after the trial they will want no other.

To you as our supplier we extend our appreciation of a very splendid product.

With best wishes for your continued success and our mutual profit, we are,

Very truly yours,

PARKS & HULL APPLIANCE CORPORATION

George J. Roche

George J. Roche
President

GJR:r

DEPENDABLE
The Byword for A-P Valves

- *Installation* — Scherr's Food Market Baltimore, Md.
- *Cabinets* — Fleetwood
- *Refrigeration Unit* — Brunner Mfg. Co.
- *Installed by* — Frame, Isaacs & Rodbell Baltimore, Md.

Phone Vernon 8787

FRAME, ISAACS & RODBELL
DISTRIBUTORS OF
..FLEETWOOD..
Complete Food Market Equipment, Commercial Refrigeration
609 NORTH EUTAW STREET
Baltimore, Md

May 20, 1938

Mr. Roche,
c/o Parks & Hull,
1035 Cathedral St.,
Baltimore, Md.

Dear Sir:-

It is indeed a pleasure to inform
that after having used various other makes of expansion valves, we are now using A.P. valves exclusively.

Since using these A.P. valves, I can say without exaggeration that our service tr
have been reduced by more than half. Our busine
is built on the good will of our customers, and
is no greater enemy of good will than a constant
need for service.

Enclosed is a picture of one of o
recent installations which we refrigerated with
Brunner Compressor and A.P. valves.

Very truly yours,

FRAME, ISAACS & RODBEL

JF:G

J. Frame.

J. Frame

VALVES

- *Purchased through* Parks & Hull Appliance Corp. Baltimore, Md.

When Installing Engineers, Service Engineers, and Refrigeration Jobbers all vouch for A-P Valve efficiency, that's Reputation well-earned. But when Valve USERS add "If you have trouble, put on an A-P Valve and forget it" — here is more proof than any "doubting Thomas" would dare quibble about.

The enthusiastic testimony of the refrigeration industry's leaders surely is sufficient evidence that A-P Valves really have something. If you have not already proved this in your own experience, we'll welcome the opportunity to give you more information.

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY — SECOND STREET
MILWAUKEE WISCONSIN

- Refrigeration Parts Jobbers, Who Recognize Quality, Stock AP Controls

Model 78 Solenoid

Model 220-
8-15 Tons Fre
Thermostati
Expansion Va

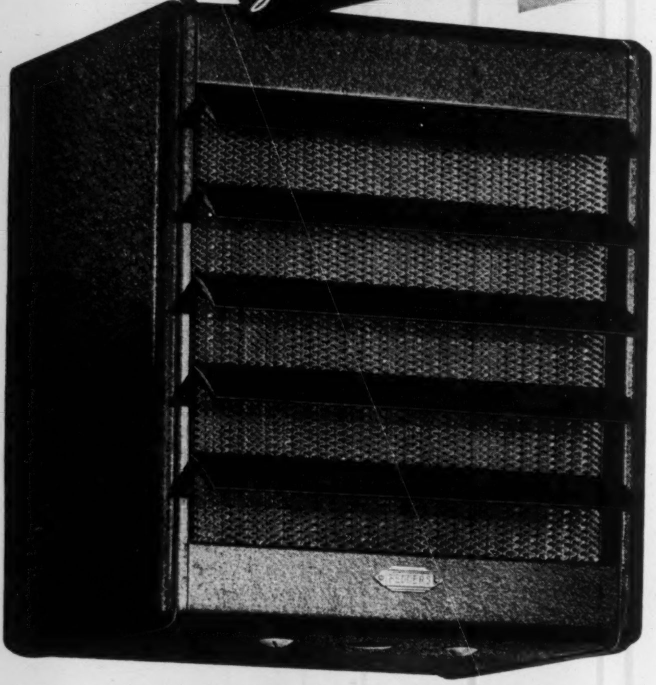
Model 205
⅞ to 2 Tons Freon
Thermostatic
Expansion Valve

Model 7
Soleno

DEPENDABLE
THE BYWORD FOR A-P VALVES

Presenting FEDDERS
Series 4 UNIT HEATERS

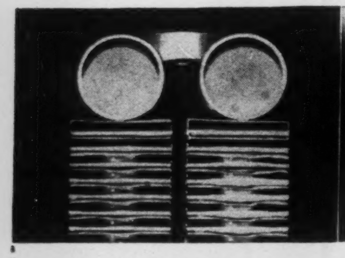
U. S. Patents
1,970,105; 2,025,426
Other Pats. Pending



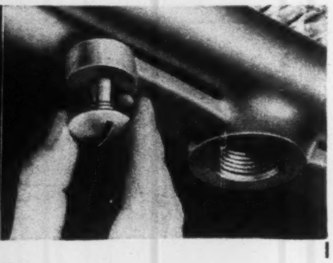
New exclusive Series 4 Double Headers for unusually free steam flow, improved Full-Floating Mountings, tubes with aerodynamically correct 3 to 1 streamline ratio and patented saddle fins prevent differential expansion stresses, improved mono-piece cabinet design with integral mouldings, those are some of the features of Fedders New Series 4 Unit Heaters.

Write for Bulletin 537 showing inside story of the new Series 4 Line.

Exclusive Series 4 cylindrical Double Headers and Saddle Fins.



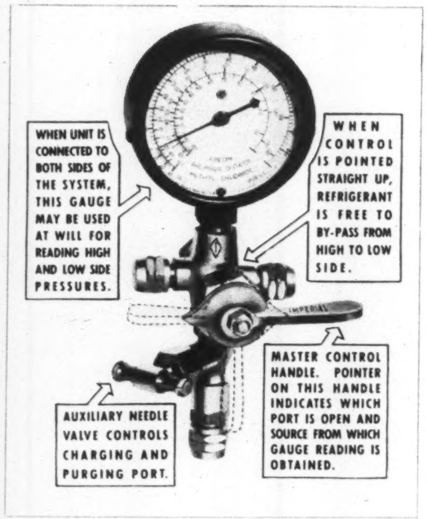
Series 4 Full Floating Element mounting eliminates expansion stresses.



FEDDERS MANUFACTURING CO.
57 Tonawanda St., Buffalo, N. Y.

Please, send copy of Series 4 Unit Heater Bulletin 537 to my personal attention.

Name ______
Concern ______
Street ______
City ______ HP-9-38


WHEN UNIT IS CONNECTED TO BOTH SIDES OF THE SYSTEM, THIS GAUGE MAY BE USED AT WILL FOR READING HIGH AND LOW SIDE PRESSURES.
WHEN CONTROL IS POINTED STRAIGHT UP, REFRIGERANT IS FREE TO BY-PASS FROM HIGH TO LOW SIDE.
IMPERIAL
MASTER CONTROL HANDLE. POINTER ON THIS HANDLE INDICATES WHICH PORT IS OPEN AND SOURCE FROM WHICH GAUGE READING IS OBTAINED.
AUXILIARY NEEDLE VALVE CONTROLS CHARGING AND PURGING PORT.

port, it may be used separately on the high side or low side, and that it is light and fits into small space.

The unit has a single control handle which operates a double acting valve. When turned to the left so that its pointer is toward the high side connection, the high side port is opened and the gage shows the high side pressure. When it is turned toward the low side connection the low side port is opened and the gage shows low side pressure.

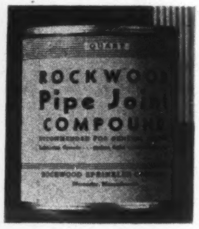
The unit comes equipped with a 30 in. to 150 lb compound gage with a temperature scale.—Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.

Adjustable Sheaves Announced

No. 1534—New adjustable "Texsteel" sheave has a range of pitch diameter varying from 2 to 3 in. and from 3 to 4 in. by merely removing the adjustable plate, reversing and again placing on the hub. As indicated in the illustration, the outer plate in the position shown at the left allows the "Texrope" belts to ride high and give a pitch diameter anywhere from 3 to 4 in.; reversed—as at the right—the belts ride low to give a pitch diameter from 2 to 3 in.

According to the maker, this sheave was developed in response to a demand for one low in cost and yet with a wide range of speed variation. It is said to be especially well suited to heating and ventilating equipment.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Pipe Joint Compound Placed on Market

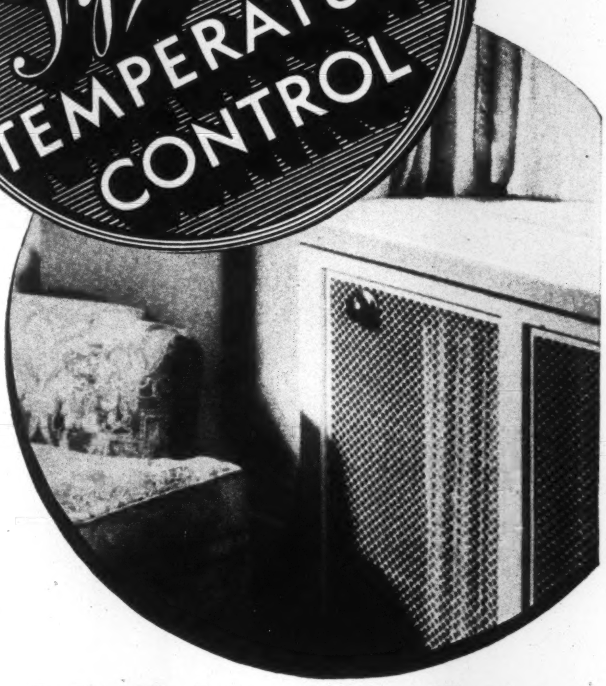

ROCKWOO
Pipe Joi
COMPOU

No. 1535—A new pipe joint compound for sealing joints and gaskets on air, oil, hot and cold water, and steam lines, etc., is being placed on the market. It has been used for over two years by the manufacturer's pipe fitters in connection with sprinkler contracting work and has been given field tests by the pipe maintenance departments of several industrial plants, it is announced.

Among the advantages listed are that it lubricates threads while the pipe joint is being made up, makes a tight metal to metal joint, the surface hardens into a protective skin which eliminates oil drops, and that it is ready for immediate use without thinning. It is available in ½ pint, 1 pint, 1 quart, ½ gallon, 1 gallon and 5 gallon cans.—Rockwood Sprinkler Co., 38 Harlow St., Worcester, Mass.

FULTON *Sylphon* FOR TEMPERATURE CONTROL

TRADE MARK



of Individual Radiators

Sylphon Automatic Radiator Valves—simply used to replace ordinary radiator valves in one room, a suite or an entire building—regulate the flow of steam to each radiator according to the individual room's comfort requirements.

Because these self-contained and self-powered reliable controls cost so little, are so easy to install in new or old buildings without alterations, and return so much in tenant satisfaction and fuel economy—they are a paying investment in any modernization project, large or small.

Made in types for both exposed and concealed radiation. This latter exclusive two-bulb balanced heat control, illustrated, utilizes both incoming cool air and outgoing heated air from the enclosure to maintain desired temperature at the breathing line. Installed entirely within the enclosure, out of sight—only the attractive adjustment knob is visible. See new bulletin below.

NEW SYLPHON BULLETINS OFFERED

Individual Room Temperature Control—Bulletins RE 80 and RE 70 . . . Zone Control—Bulletin RE 70 . . . Space Heat Control in Large Industrial Areas—Bulletins RE 50 and RE 70 . . . Duct Type Heating and Air Conditioning Controls—Bulletin RE 50 . . . Service Hot Water Supply Control—Bulletins RE 20 and RE 40 . . . Drinking Water Temperature Control—Bulletin RE 20.

THE FULTON SYLPHON CO.
KNOXVILLE, TENNESSEE
Representatives in All Principal Cities in U. S. A. and in Montreal, Canada and London, England

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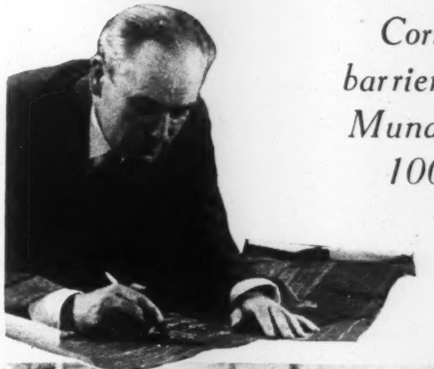
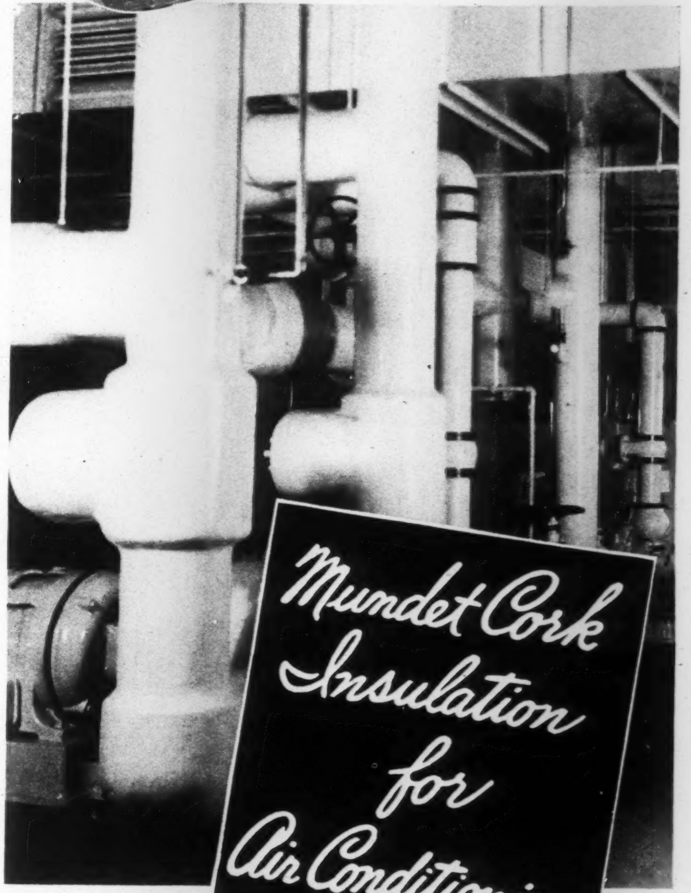


Cork is a natural barrier to heat flow . . . Mundet Insulation is 100% pure cork.



Mundet Cork Insulation for Air Conditioning

CORK BOARD

●

CORK PIPE COVERING

●

CORK ISOLATION FOR MACHINERY VIBRATION

●

It pays well to specify Mundet Cork Insulation because it offers a natural barrier to heat flow. Unsurpassed for low thermal conductivity, Mundet Cork is moisture resistant, sanitary and long lasting. See our catalog in Sweet's, or write for insulation data.

MUNDET CORK
CORPORATION
INSULATION DIVISION
65 S. Eleventh Street, Brooklyn, N. Y.
Offices in Many Cities

TALLMADGE
Zoned Controlled
HEATING

The MODULATING ZONE CONTROL VALVE is an electrically operated valve (operated automatically or manually) for controlling each zone. This Valve is really the "heart" of Tallmadge Zoned Heating.

BETTER HEATING AT LESS COST
GIVES GREATER COMFORT
Improves Air Conditioning

WEBSTER TALLMADGE & CO.
NEW YORK CITY

Tube Shaping Tool Announced

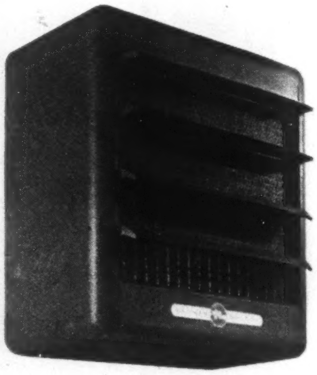
No. 1536**—One of the features of a new tube shaping tool is that one can bend, cut, flare and swedge with it. It is offered for use with copper and brass tubing and is also successful for bending aluminum tubing, says the maker.

One tip is used for all size flares. There are separate tips for each size swedge. Swedges can be made larger by using size larger tip than used for the first swedge.

The tool comes complete for bending ⅜-1 in. radius, ½-1½ in. radius, ⅝-2 in. radius, and ¾-2½ in. radius, outside diameter soft temper tubing. Cutting capacity is 2⅛ in. outside diameter and smaller.—Sac Tool Mfg. Co., 1907 Washington Ave., St. Louis, Mo.

New Propeller Fan Unit Heater Announced

No. 1537—New propeller fan "hiJet" unit heater is offered for steam or hot water heating of all types of industrial and commercial buildings. It is available in a range of 18 sizes with air capacities of 275 to 5060 cfm.



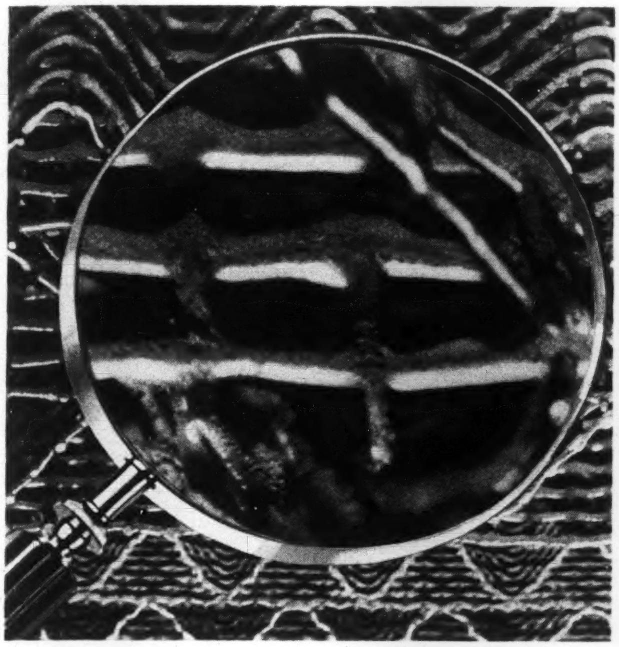
According to the maker, the fan is a new streamlined design with large face area and provides quiet and smooth operation with high efficiency. The heating element is designed with loops to absorb difference in expansion and contraction between individual tubes and is fabricated of red brass with no connecting joint to weaken construction. The motor—for single, two, or three speed operation—and fan assembly are mounted on steel arms designed to absorb and dissipate vibration.

Louvers are adjustable and a grille or discharge nozzle may be used in place of them. Cabinet is of heavy gage sheet steel furnished in steel grey "Morocco."—Herman Nelson Corp., 2nd St., Moline, Ill.

Develops Line of Gas Fired Equipment

No. 1538*—A new line of gas fired heating and air conditioning equipment for industrial, commercial and residential applications announced last month includes three models of suspended type unit heaters, and three models of floor type unit heaters with input capacities ranging from 45,000 to 85,000 Btu; and three models of suspended type gas air conditioners and three models of floor type conditioners with input capacities from 90,000 to 180,000 Btu.

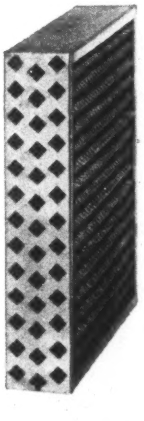
All controls and other mechanical parts of the unit heaters are completely enclosed in a furniture steel cabinet. After the pilot has once been lit, the thermostat will automatically turn on the heater and turn it off as required. Should the gas or electric



MAGNIFIED section of "loaded" element shows how dust is impinged evenly on precisely arranged wire baffles—no clogged areas.

AIR-MAZE
PERMANENT CLEANABLE
FILTER PANELS

The Answer to your Air Filter Problem



- *99.3% — 99.8% Efficient*
- *Easily Cleaned, Charged*
- *Very Low Pressure Drop*
- *No Replacements Needed*

Air-Maze panels are easy to clean and recharge. They are then ready for continued service and have the characteristics and performance of new filters!

MORE than fifteen years of air filter engineering are back of Air-Maze filters. Thoroughly effective application of the baffle-impingement principle has been achieved by Air-Maze engineers through a scientific arrangement of selected mesh screens resulting in exactly graduated progressive density in the element.

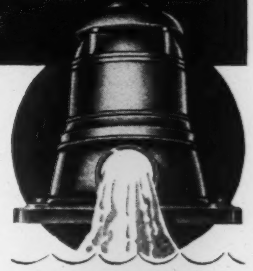
Every square inch of the filter handles an equal volume of air. No weak spots to lower efficiency—no restrictive areas to raise velocity. Deposit *"pyramids" evenly* throughout the element.

Specify Air-Maze for greater efficiency and economy. Write for Bulletin PPS-38. Specific engineering data for your air filter problems supplied without obligation.

AIR-MAZE CORP., 5200 *Harvard Ave., Cleveland, O.*

AIR-MAZE
CLEANABLE AIR FILTER PANELS

Another Big Paper Mill
SELECTS LAYNE WELLS AND TURBINE PUMPS



WITH a capacity of 18,000,000 gallons daily, three Layne designed, drilled, and turbine pump equipped wells now serve the Brunswick Pulp and Paper Company's newly erected Brunswick, Georgia, plant. These Layne wells were successfully passed through, and cemented against, bad water formations,—a task that required much skill and care. Special equipment was necessary to core through hard limestone formations for the setting of full size, 3/8 inch thick by 18 inch diameter, welded continuous steel casings. The casings were then cemented at the bottom to the Eocene formation.

AFFILIATED COMPANIES

Layne-Arkansas Co.	Stuttgart, Ark
Layne-Atlantic Co.	Norfolk, Va
Layne-Central Co.	Memphis, Tenn
Layne-Northern Co.	Mishawaka, Ind
Layne-Louisiana Co.	Lake Charles, La
Layne-New York Co.	New York City and Pittsburgh, Pa
Layne-Northwest Co.	Milwaukee, Wis
Layne-Ohio Co.	Columbus, Ohio
Layne-Texas Co.	Houston and Dallas, Texas
Layne-Western Co.	Kansas City, Mo, Chicago, Ill., Minneapolis, Minn and Omaha, Nebraska
Layne-Bowler New England Company	Boston, Massachusetts
International Water Supply, Ltd.	London, Ontario, Canada

So again Layne does an outstanding job on a difficult undertaking.

Industries or municipalities contemplating the installation of a new water supply system, or seeking a reduction in water costs, may obtain valuable information by addressing Layne & Bowler, Inc. Here they will be guided by the World's most respected Deep Well water production experience. And, of course, Layne Pumps are equally well known for their records of high efficiency, long life, and low cost. For literature or consultation, without obligation, address LAYNE & BOWLER, INC., DEPT. K, Memphis, Tenn.

LAYNE

PUMPS & WELL WATER SYSTEMS

For Municipalities, Industries, Railroads, Mines and Irrigation

AirMaster

GRILLES

The Final Step in Modern Air Conditioning

Now, with AirMaster Grilles, you can make up grille assemblies to cover every air-conditioning need. AirMaster grilles, dampers and frames are completely interchangeable making it possible for you to select from standard stock the exact combination needed to satisfy air - conditioning, structural and architectural requirements.

Other new AirMaster features include: Graduated volume control—"Camera shutter" size control—4-way direction control.

Get the Details on Improved AirMaster Grilles

Write for your Free copy of the new catalog which gives complete information on AirMaster Grilles and the "Build-Up" Selection Method.

WATERLOO REGISTER CO.

Waterloo, Iowa **Seattle, Wash.**

In New York City—Air Conditioning Utilities, 8 W. 40th St.

supply fail, the main gas valve automatically closes. A feature is that the entire heat generator and heat exchanger assembly is insulated from the casing by a cushion of air. The heat exchanger element is made of non-ferrous metal, die formed, and the heat generator is also of non-ferrous construction which is light in weight.

The gas fired air conditioners may be used with any standard arrangement of ducts, and outside or recirculated air connections are made as with hot water or steam heating units. The unit is so constructed that the cooling section for summer air conditioning may be added later, if desired.—Trane Co., La Crosse, Wis.

Booklets, Reports and Papers

Air Conditioning Reduces Pneumonia

Discovery that air conditioning apparently eliminates 99 per cent of post-operative pneumonia is reported at Corey Hill hospital, Brookline, Mass. Rigid control of humidity, which was kept constantly low at 30 per cent, appeared to be fully half the cause of improved vigor.

Lung trouble is one of the risks of surgical operations for which no satisfactory preventive heretofore has been found. It happens after 6 to 7 per cent of operations, according to a survey made by the Massachusetts General Hospital. Most frequently these complications appear after operations on the stomach, gall bladder and intestines, and twice as often among men as women.

But at Corey Hill, with air conditioning in all bedrooms, operating rooms, and solarium, 743 operations in a year resulted in only one case of post-operative pneumonia. Recovery in this case was quick. The experiment is described by the hospital's medical director, Dr. Albert G. Young, in the August *Hospitals*, official magazine of the American Hospital Association.

The 40 bed hospital was built for air conditioning. It uses no recirculated air. Outside air is continually drawn in, cleaned, and either warmed or cooled. Humidity is either increased or decreased. The relative humidity was maintained at 30 per cent with a margin of not more than 2 per cent. The only exception was during operations, where the humidity was raised to about 55 per cent to protect against possible explosions of anesthetic gases. As the pneumonia does not develop until two or three days, the operating room humidity did not appear to be a factor in the lung troubles.

Temperatures in summer were allowed to rise to 78 when it was 95 to 100 F outdoors. In subzero weather, room temperatures were kept at 75 F. The air in the rooms was changed every 15 minutes, but without any drafts.

At headquarters of the Air Conditioning Manufacturers' Association, W. B. Henderson, executive vice president, added that air conditioning in hospitals has also proved beneficial for hay fever and asthma patients, in nurseries for prematurely born babies, and for cardiac patients.

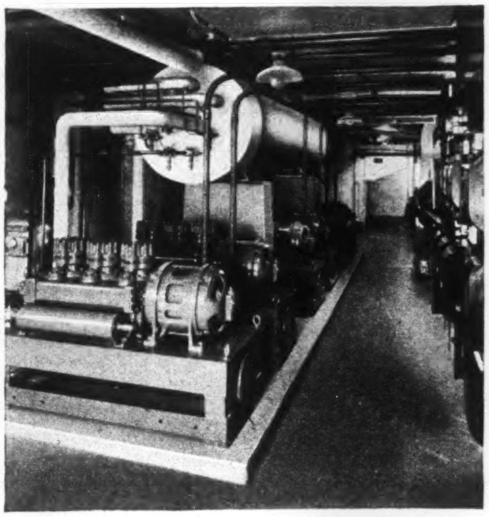
Fan Test Code Being Distributed

Distribution is now being made of the third edition of the "Standard Test Code for Centrifugal and Axial Fans," by the National Association of Fan Manufacturers, 5-208 General Motors Bldg., Detroit, Mich. The price is 25c.

The code is sponsored jointly by the American Society of Heating and Ventilating Engineers and the fan association with cooperation of the power test code committee of the American Society of Mechanical Engineers.

The third edition involves clarifications of definitions; finite statements concerning the several methods of testing as applied to various types and arrangements of fans; addition of "egg crates" or straightening vanes to ducts; a reduction of the allowance for duct friction; and modification of the pitot tube.

Patterson Freon Multi-Circuit Water Coolers



Patterson Multi-Circuit Cooler in First National Bank Bldg., Lincoln, Neb.

FEATURES

A separate Freon Circuit for each compressor.

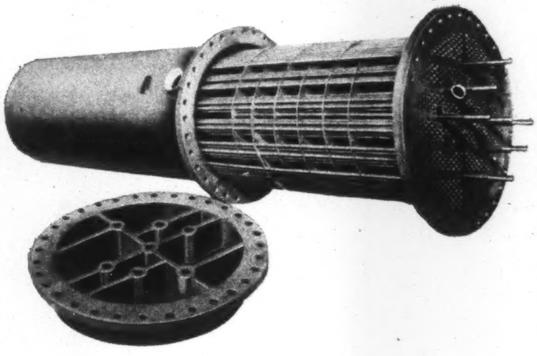
Rustless cooling tubing made of U-shaped copper. Removable cooling elements. No strain from expansion and contraction of tubing and no loss of Freon.

Efficient cooling operation. Positive superheat. Positive oil return.

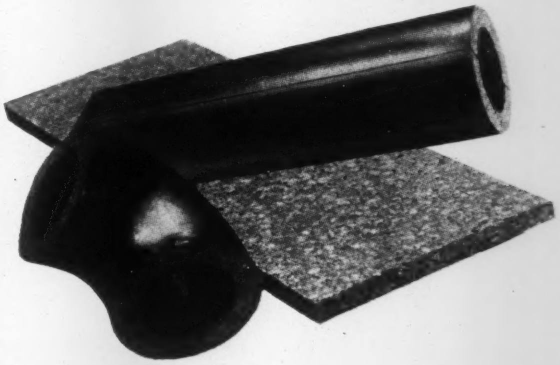
Tested and absolutely tight under a Freon pressure of 225 lbs. square inch.

Write for Catalog.

The Patterson-Kelley Co., Inc.
107 Warren St., East Strousburg, Pa.



SAVE *air-conditioning* DOLLARS *with* CORK INSULATION



FROM the bark of the CORK TREE, nature's own insulator, Novoid Cork Insulation is fabricated into two efficient forms for use in making air conditioning systems operate more efficiently and economically. Novoid Corkboard is ideal for insulating both square and rectangular ducts. It also prevents the infiltration of warm air into air-washing rooms. Novoid Cork Pipe Covering is equally efficient for insulating cold water risers, return lines and attendant air conditioning piping.

Properly installed, Novoid Cork Insulation forms an effective barrier to the passage of heat and also prevents condensation from forming. It is light in weight, structurally strong, easy to erect, and available in a wide range of sizes to meet every insulating need. Let Novoid help you save air conditioning dollars. For more complete details mail the coupon below. Cork Import Corporation, 330 West 42nd Street, New York City.

NOVOID CORK INSULATION

Cork Import Corporation
330 West 42nd Street
New York City

Please send me complete information on Novoid Corkboard and Cork Pipe Covering for air conditioning systems.

Name ....

Street ....

City .... State ....

G&O RADIATION

FINNED COILS

G&O FINNED RADIATION COILS for all industrial applications are available in a wide range of sizes, for high and low pressure operation.

SEND FOR CATALOG

THE G&O MANUFACTURING COMPANY
New Haven, Connecticut
Pioneer Manufacturers of Square Finned Tubing in the United States

CLINTON
PERFORATED METAL
GRILLES
Are Accurate

Clinton Grilles are made on the most improved machinery and with dies kept in good condition. The mechanics are skilled and accustomed to perforating the finest work. Clinton Grilles lie flat. There is never a spread, a warpage or buckle to consider. When your order specifies to a thirty-second of an inch, you get it. That is why Clinton Grilles always fit.

WICKWIRE SPENCER STEEL COMPANY
41 East 42nd Street, New York
Buffalo Worcester Chicago San Francisco

Clinton Grilles are regularly made in various gages of steel, brass, bronze, monel and Wissco Bronze, and are available up to 60" x 156" in all finishes. Send for the new GRILLE FOLDER that gives full information.

CLINTON
Perforated METAL GRILLES

WICKWIRE SPENCER perforated metals

Bibliography on Industrial Radiography

Herbert R. Isenburger, St. John X-Ray Service, Inc., has completed a 52 page bibliography on industrial radiography comprising 776 references. It supplements his book on the subject published in 1934 by John Wiley & Sons.

The bibliography may be obtained from American Documentation Institute, 2101 Constitution Ave., Washington, D. C., ordering Doc. 1139. Cost for copy in microfilm (35 mm standard safety photographic film for use in reading machines) is 72 Cost of bibliography in typescript form is $3.32.

Detecting Hydrogen Cyanide Vapor

Leaflet No. 2 in the series on methods for the detection of toxic gases in industry issued by the British Department of Scientific and Industrial Research is devoted to hydrogen cyanide vapor, which is manufactured mainly for use in fumigation and which is encountered in concentrations which may be dangerous in certain industries. Among these industries are blast furnaces, dyestuffs works, gas works and coke ovens, gold mining, and others.

The booklet discusses poisonous effects, methods of detection (with detailed instructions), and first aid, and includes charts showing standard stains produced on congo red-silver nitrate paper and on benzidine-copper acetate paper. Copies are available from the British Library of Information, 270 Madison Ave., New York, N. Y., for $1.65.

Book Reviews

Thermodynamics, Fluid Flow and Heat Transmission

["Thermodynamics, Fluid Flow and Heat Transmission," by Huber O. Croft, Head of Department of Mechanical Engineering, University of Iowa. 1st ed. 1938. 312 + xi pp., 6x9 in., clothbound. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y. Price, $3.50.]

This new book covers a novel area in the field of engineering, its purpose being to review thermodynamics and introduce dimensional analysis, fluid flow and heat transmission problems—subject matter fundamental in the training of all engineers. The material is combined into one continuing study, as are actual engineering problems, rather than to separate it into "small individual packets of extremely specialized knowledge," each with a specialized course title and requiring a separate text.

The book presupposes an elementary knowledge of thermodynamics and hydraulics, though brief reviews of these subjects are included. The author has made a serious attempt to express the constants of all important equations in units and dimensions determined from the logic of dimensional analysis, without the introduction of arbitrary multipliers.

Following are the chapters which are included: Definitions and units; dimensional analysis and the principle of similitude; thermodynamics of perfect gases; general differential equations applying to thermodynamics; thermodynamics of vapors and equations of state; analysis based upon the second law of thermodynamics; flow of fluids; measurement of fluid flow; heat transmission; engineering characteristics of solid particles in fluid streams; and compression of fluids An appendix includes tabular and plotted data.

Air Conditioning

["Air Conditioning," by Charles A. Fuller, consulting engineer, with the collaboration of David Snow, air conditioning engineer. 1st ed. 1938. 577 + ix pp., 6x9 in., clothbound. Published by

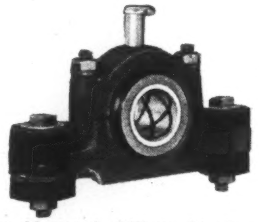
USE THE BEARING WITH A FUTURE

Randall

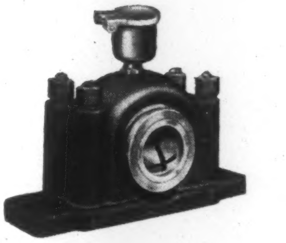
Randall Pillow Blocks are built with a thought to the future on a foundation of long experience. Thirty-two years of bearing study and manufacturing plus the finest materials on the market go into each Randall Pillow Block. The graphite used in Randall bronze bushings is an exclusive Randall formula. It will not crumble or become soft and it wears evenly with the bronze, providing a considerable degree of lubrication to the shaft regardless of the possible failure of other lubricant. Randall Pillow Blocks will last a lifetime if given reasonable care.

Self-aligning and self-lubricating. Randall Pillow Blocks operate with a minimum running torque. In blower systems equipped with these fine bearings metallic bearing noise is eliminated.

Contractor and user satisfaction is assured by building Randall Pillow Blocks into your units. Use Randall Pillow Blocks to end bearing worries.



*Rubber Mounted Pillow Block—Isolates the supporting members at the contact point of the frame or blower housing. The oil resisting rubber grommets absorb foreign noise and vibration.



Randall Universal Pillow Block—An extremely versatile double reservoir bearing that can be mounted in any position simply by unscrewing the oil cup, turning the ball and reinserting the oil cup in a vertical position.

**Also supplied with large oiler.*

Write for 1938 catalog describing, in detail, the complete line of Randall Pillow Blocks.

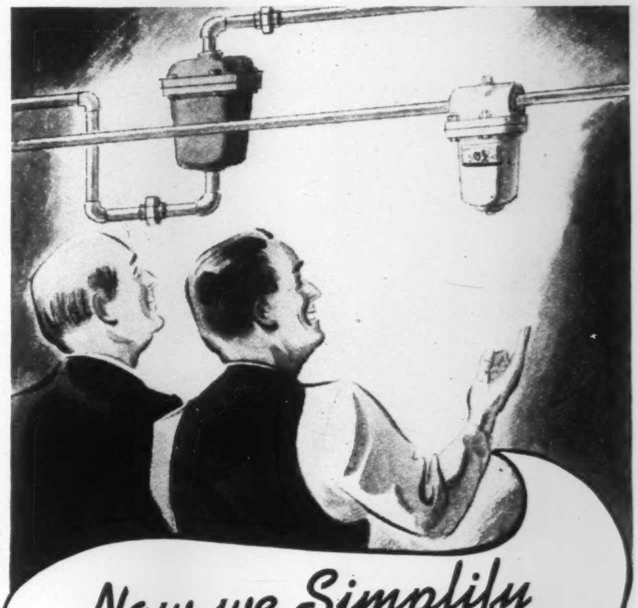
EASTERN STOCKS

Tek Bearing Co. 177 La Fayette New York City	American Stock Gear Co. 100 St. Clair Ave., N. W. Cleveland, Ohio

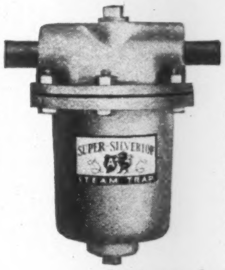
PACIFIC COAST STOCKS

Utility Fan Corp. Los Angeles, Cal.	C. W. Marwedel San Francisco, Cal.

***Randall* GRAPHITE PRODUCTS CORP.**
Dept. 910 609 W. Lake St., Chicago, Ill.



Now we Simplify with Anderson
SUPER-SILVERTOPS



"In the past we used to use old style traps with complicated piping. Now we simplify our steam trap piping with Anderson Super-Silvertops at a real saving in fittings and labor. This Super-Silvertop type makes the old type trap obsolete. Here's why. You can see the saving in fittings by comparing those two traps up there—that's one reason. The traps can be inspected right on the line at a saving in maintenance time—that's another reason. The extra capacity is a reserve for any heavy, unforeseen load.

"With all those advantages, we pay no more for the trap than we would for any other make. Do you wonder that we decided to change? It was a case of much to gain and nothing to lose."

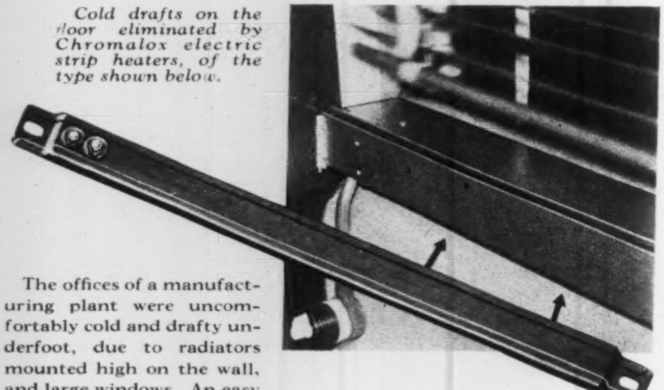
Each Anderson Super-Silvertop trap is backed by 54 years of steam trap manufacturing experience. Constant research through these years is responsible for the reliability and long life of each Anderson trap.

Find out for yourself what this trap can do. Write today for complete details about saving by simplifying with Anderson Super-Silvertops.

THE V. D. ANDERSON CO.
1949 West 96th Street • Cleveland, Ohio

***Anderson* SUPER-SILVERTOP**

Electrically heated window sills
made this office comfortable



Cold drafts on the floor eliminated by Chromalox electric strip heaters, of the type shown below.

The offices of a manufacturing plant were uncomfortably cold and drafty underfoot, due to radiators mounted high on the wall, and large windows. An easy solution was found in the construction of metal housings serving as air ducts on the window sills (as shown in the photo) in which were mounted standard 500-watt Chromalox electric strip heaters, provided with three-heat switch. The installation was simple and the entire cost low.

Not only is this arrangement completely successful in extreme weather, but it has also demonstrated an unforeseen advantage in mild temperatures, Spring and Fall, when it supplied all the heat needed, making boiler plant operation unnecessary. This is a particular convenience in overtime office work.

Chromalox electric units in their many types have been the easy way out in hundreds of problems, for industrial heat generally as well as for comfort. The Chromalox Book of Electric Heat (on request) tells how. Wiegand engineers are glad to help. Write us.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. **Pittsburgh, Pa.**

A Better Spray NOZZLE for Water Cooling

This MARLEY Non-Clog Nozzle Saves Industry Many Thousands of Dollars Each Year!

Because it operates efficiently at low pressures it saves on pumping cost.

Because it has no internal parts to clog or wear it saves on cleaning, repair and replacement cost.

Because of its finer, more uniform spray it is the most effective water cooling nozzle ever devised, saving on the number required to handle any given heat load.

Write Now for Bulletin 100!

Many Special Types for Special Purposes Including

Air Humidifying

Ice Melting

Air Washing and Brine Spraying

The MARLEY Company
Fairfax and Marley Roads, Kansas City, Kansas
Sales Offices or Agents in Principal Cities

Norman W. Henley Publishing Co., 2 W. 45th St., New York, N. Y. Price, $4.00.]

This new text is intended as a practical and fundamental treatise on air conditioning, refrigeration, comfort cooling, humidification and air purification. The author has eliminated a great deal of the technical phraseology in order to present the subject with the greatest simplicity of expression.

Chapters are given on air and its properties; load calculations; duct design and air distribution; registers and grilles; heating and humidification; fans; cooling coils and air washers; fundamentals of refrigeration; compressors, condensers, evaporators and allied equipment; well water cooling—ice cooling and storage systems; evaporative condensers and cooling towers; small store installations—unit coolers; automatic control; air cleaning and purification; and codes and ordinances.

Conventions and Expositions

International Management Congress: September 19-23, Washington, D. C. Sponsored by the National Management Council of the U. S. A. Headquarters, Room 1201, 347 Madison Ave., New York, N. Y.

National Industrial Advertisers Association: Annual conference, September 21-23, Cleveland, Ohio. Committee Chairman, Stanley Knisely Advertising Manager, Republic Steel Corp., Republic Bldg., Cleveland, Ohio.

Iron and Steel Exposition: September 27-30, Cleveland Public Auditorium, Cleveland, Ohio. Under the direction of the Association of Iron and Steel Engineers, Empire Bldg., Pittsburgh, Pa.

American Welding Society: Annual meeting (in conjunction with Metals Congress Exposition), October 16-21, Book-Cadillac Hotel, Detroit, Mich. Secretary, M. M. Kelly, 33 W. 39th St., New York, N. Y.

Food Preservation Conference: October 20-21, University of Tennessee, Knoxville, Tenn. Sponsored jointly by the University and the American Society of Refrigerating Engineers.

American Public Health Association: Annual meeting, October 25-28, Kansas City, Mo. Headquarters Office, 50 W. 50th St., New York, N. Y.

Power Show: National Exposition of Power and Mechanical Engineering, December 5-10, Grand Central Palace, New York, N. Y. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

Refrigeration and Air Conditioning Accessories Exhibition: January 16-19, Stevens Hotel, Chicago, Ill. Manager and Committee Secretary, R. M. McClure, 111 W. Washington St., Chicago, Ill.

American Society of Heating and Ventilating Engineers: Annual meeting, January 23-26, William Penn Hotel, Pittsburgh, Pa. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

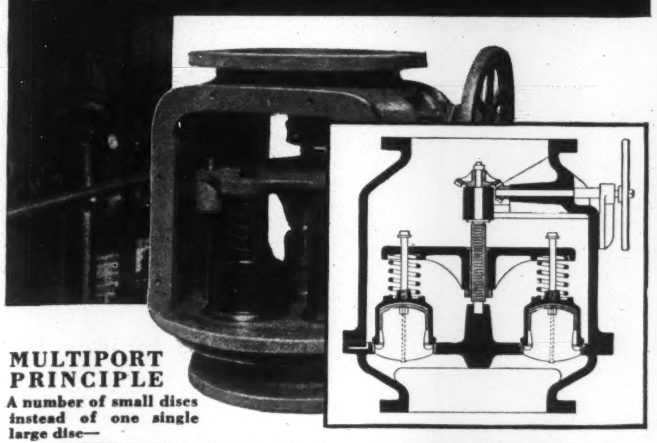
Schools and Study Courses

Evening Courses for Engineering Graduates

Stevens Institute of Technology, Hoboken, N. J., is offering for the first time during the academic year 1938-1939 a program of evening graduate courses. Coordinated groups of related courses are offered in the fields of mechanical engineering, electrical engineering, and economics of engineering. Air conditioning is included.

With the exception of a few noncredit courses, each carries credit leading to the degree of master of science. Although an essential qualification is graduation from a course in engineering or applied science, admission to graduate courses is open to those otherwise qualified.

Cannot Stick, Jam or Freeze



MULTIPORT PRINCIPLE

A number of small discs instead of one single large disc—

INSURES CONTINUOUSLY RELIABLE OPERATION

COCHRANE MULTIPORT RELIEF VALVE

The Cochrane Multiport Valve, for the control of atmospheric relief, back pressure, flow or check valve service, uses a multiplicity of small valve discs. These fit tightly against seats, yet are released freely; no possibility of jamming or freezing—no tendency for chatter or seat-pounding.

These valves are especially valuable for steam condenser service where positive tightness under high vacuum is vital. They are giving protection in more than 12,000 plants. If *you* want absolute insurance against damages from relief valves that now stick or jam, install Cochrane Multiport Valves. Write for copy of 16-page Publication No. 2710.

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NO OTHER UNIT HEATER LIKE the GRID
ASK FOR THIS TEST ON THE GRID
GRID

The GRID Unit Heater is a permanent piece of heating equipment that can be depended on to function year after year without trouble or attention. A RECENT BREAK-DOWN TEST AT PITTSBURGH ON A GRID SECTION TAKEN FROM STOCK RESULTED IN FRACTURING THE SECTION AT 2800 POUNDS HYDROSTATIC PRESSURE PER SQUARE INCH. This shows that our claims for Grid stability are correct, and why maintenance cost of GRID Unit Heaters is eliminated. What other unit heater has such a record?

Grid is trouble free because it is not affected by electrolytic action. In it are no dissimilar metals in contact with steam or hot water to produce electrolytic action. THE FIRST GRID UNITS MADE IN 1929 ARE STILL IN USE—WITH MANY YEARS OF SERVICE YET AHEAD OF THEM. Write for complete details.

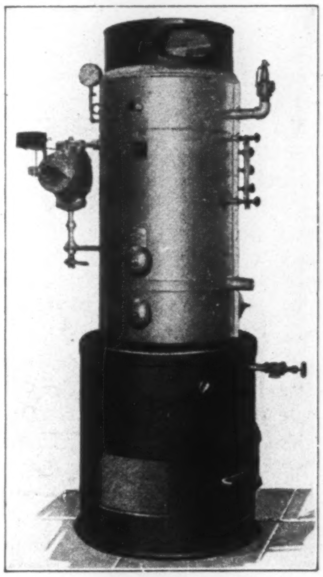
The Unit Heater & Cooler Co.

Offices in all principal cities Wausau, Wisconsin

GRID
UNIT HEATER

AN OIL-FIRED STEAM BOILER

QUICK **STEAMING, EFFICIENT**



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A very well built Boiler of the vertical fire tube type. Standard boilers built for pressures up to 100 lbs.—boilers for higher pressures built to order.

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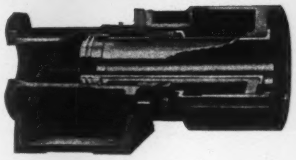

It can be
UNPACKED *and* REPACKED
Under Full Operating Pressure

No interruption to service. Piston Rings in the internal guide hold the line pressure during the unpacking and repacking operation.

Fully guided by an internal guide ring and by an external guide in the two-piece hood. Available in single or double joints for high pressures and high temperatures with flanged or beveled ends.

Write for Bulletin 35-15 HP

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Delco Appliance Corp., Rochester, N. Y.

American Enka Corp., Enka, N. C.

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NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS

REASONS
why you should consider
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UNIT HEATERS

¶ One of the FIRST of standard accepted Unit Heaters.

¶ Properly engineered and designed to meet general requirements.

¶ Highly efficient and compact for all commercial and industrial heating applications.

¶ Equal distribution of heat throughout the all copper heating element.

¶ Heating element fully cradled—"it floats."

¶ Attractive cabinets trimmed with stainless steel.

These and many other points make the McQUAY UNIT HEATER, in a line of sizes, outstanding values on the market today.

A descriptive bulletin is yours for the asking.

McQUAY Inc.
1600 Broadway N. E.
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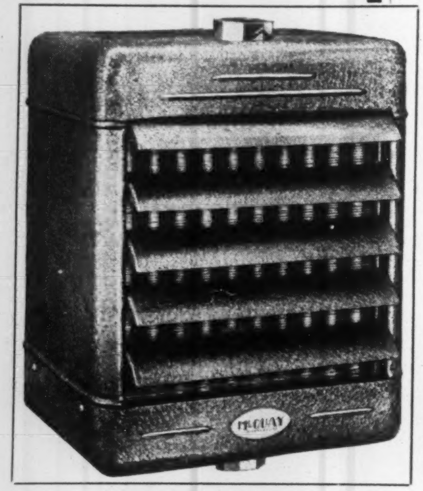

RIDGID
No 1 & 2
PAT. No 1932563-CANADA 33

This Unusual RIDGID
Alloy Tool-Steel Wheel-Blade Gives
You ● Faster
● Lower Cost
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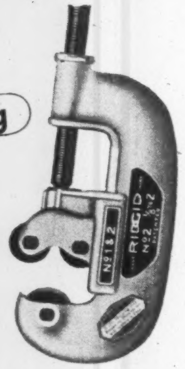


Your skill at mechanics makes it easy for you to see why this RIDGID Cutter with its new style wheel-blade can cut pipe more quickly and cleanly and last far longer, giving you extra economy.

For the RIDGID knife-like blade is coined out of fine tool steel, hammered, heat-treated and then assembled in the hub. That's what gives it the unusual stamina for hundreds of extra cuts, reducing cutter wheel expense, as thousands of users know.

Powerful housing, guaranteed warp-proof, always cuts true, twirls easily to your pipe size. You like the "feel" of this tool, enjoy working with it.

For time and expense saving and a tool you get a "kick" out of owning and using, buy the RIDGID Cutter — at your Supply House.

THE RIDGE TOOL CO., ELYRIA, OHIO

RIDGID PIPE TOOLS

Sessions for the first semester start during the week of September 26. Further information may be had from Professor Frank C. Stockwell of Stevens.

Evening Air Conditioning Instruction

The School of Architecture of Columbia University, New York City, will offer a varied group of courses of a professional nature during 1938-1939. Among them are a basic or general course on air conditioning, outlining the scope of the industry, its field of activity and its fundamental principles, and a technical air conditioning course for advanced students in mechanical engineering and for those who have had sufficient technical experience in the laboratory, field or office. Instructor for the first course will be E. H. Taze of American Blower Corp., and A. J. Lawless, associated with Hubbard, Richard and Blakely, consulting engineers, will teach the advanced course.

The winter session courses begin on September 29, and the spring session courses on February 8. Detailed information may be had from George M. Allen, executive officer, School of Architecture, Columbia University.

Air Conditioning and Heating Courses

The Herkimer Institute, 1819 Broadway, New York City, has announced day and evening courses in refrigeration, air conditioning and refrigeration, and in oil burners and automatic heating. The evening refrigeration course meets on Tuesdays and Thursdays, the evening air conditioning and refrigeration course on Mondays and Wednesdays, and the evening oil burners and automatic heating course on Mondays and Wednesdays. The student may start at any time.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 126. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 2922. AIR CIRCULATORS: Emerson Electric Mfg. Co., 1847 Washington Ave., St. Louis, Mo. 12 p. air circulator catalog (X2458) describing three and four blade circulators, ceiling, wall bracket, counter column and adjustable floor column mountings, with complete descriptions and specifications, and information on how and where to install the equipment.

No. 2923. AIR CONDITIONING: Frick Co., Waynesboro, Pa. 12 p. bulletin (505-A) on systems of air conditioning, illustrating and diagramming multiple unit system, controlled air volume system, automatic bypass system, direct system, and cooling with chilled water. Also, 2 p. specification sheet (217-A) on low pressure condensing units of 10 ton capacity for air conditioning.

No. 2924. AIR CONDITIONING STORES: Carrier Corp., Syracuse, N. Y. 6 p. folder showing self-contained air conditioning units now available in 3, 5, and 10 ton sizes. Diagrams show floor space occupied by them in comparison with other store equipment.

No. 2925. ECONOMIZERS: American District Steam Co., North Tonawanda, N. Y. 2 p. bulletin (35-76) on "Adsco" heat economizers for preheating domestic cold water supply by hot condensate from return lines. Diagrams of instantaneous and storage types are shown and graphs are given.

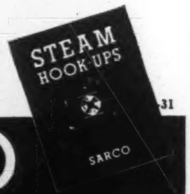
No. 2926. FAN BLADES: Torrington Mfg. Co., 70 Franklin St., Torrington, Conn. 12 p. bulletin (123738) on "Airistocrat" propeller fan blades, tabulating specifications and available sizes, and graphing air delivery and power consumption.

No. 2927. FLOAT VALVE CONTROLS: Frick Co., Waynesboro, Pa. 8 p. bulletin (201-C) on float valve controls for automatic regulation of the refrigerant feed in cooling systems. Drawings show arrangements for various applications.

THE SARCO WATER BLENDER

Blended water at correct temperatures from any main line at no added expense! Saves on hot water expense in washrooms, showers and process work. Increases effective capacity of heaters already installed. It's a thermostatic mixer—needs no reducing valves. Set it once, and it delivers hot water at the predetermined temperature, regardless of fluctuations in hot and cold water supply or pressure. Also used for cooling coils or jackets. Ask for Catalog No. 140.

ASK FOR THIS NEW DATA BOOK
—On your business letter-head. Shows how to hook up all types of heating, air conditioning and process equipment with suitable traps and control.



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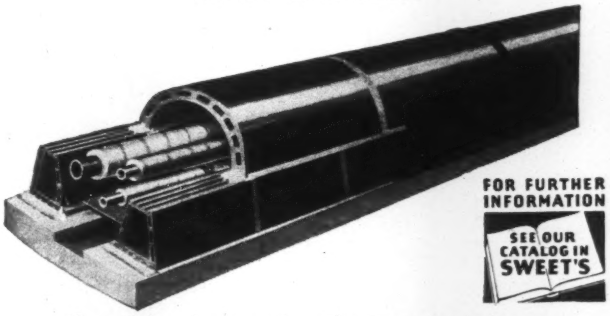
The Conduit for Underground Steam Lines

Simplest
Strongest
Most Efficient



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Complete data and estimates on request.

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H. W. PORTER & CO., INC.
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● This new book is necessary in your air conditioning business. Makes estimating and planning easier —helps lower costs of complete installation.

The Moncrief Patented Lock Joints on wall stacks, stack heads, foot-pieces and trunk duct fittings make a more efficient, neater job that is easier to install.

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THERE'S A DIFFERENCE

Let's get down to the facts about Dart savings. When the two extra wide bronze seats of a Dart union come together, they make contact over their entire width. The reason: Dart seats are ground—on special oscillating grinders of Dart's own design—to a true ball joint. In other words: matched surfaces that assure permanent tightness under repeated use.

And moreover the special air refined malleable iron used in Dart bodies and nuts gives top resistance to pipe strains, wrench abuse and thread distortion. All these features add up to *lowest cost per tight joint.* That's real economy. Send today for a Dart to try. No obligation.

SALES AGENTS: THE FAIRBANKS COMPANY NEW YORK AND ALL BRANCHES
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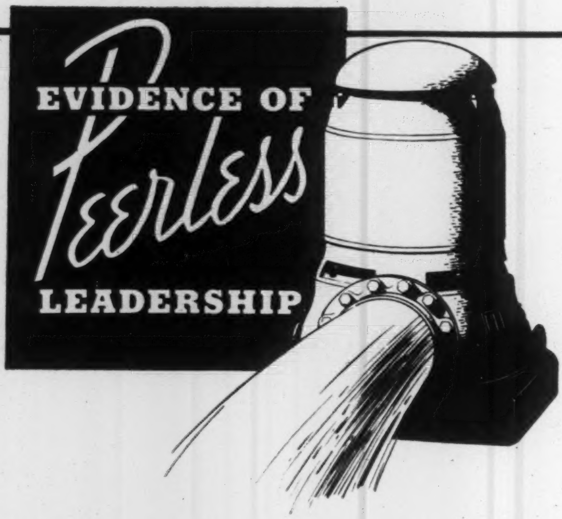
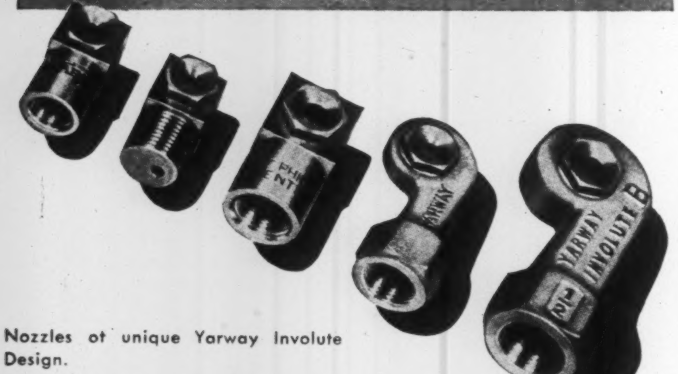
UNIONS
E. M. DART MFG. CO., PROVIDENCE, R. I.



Nowhere are more exacting demands made of a deep well pump than in municipal service. It is significant, then, that the roster of Peerless owners bulks large in the municipal field. From the great city of New York down to the tiniest village, these communities know that Peerless Pumps live up to their world-wide reputation for performance and durability.

PEERLESS PUMPS
FOOD MACHINERY CORPORATION
Massillon, Ohio
Los Angeles, California *San Jose, California*

AIR CONDITIONING NOZZLES



Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-615.

YARNALL-WARING COMPANY
MERMAID AND ANDERSON STS.
PHILADELPHIA

YARWAY

No. 2928. HAY FEVER: Delco-Frigidaire Conditioning Div., General Motors Sales Corp., 1420 Wisconsin Blvd., Dayton, Ohio. 16 p. booklet on relief from hay fever and kindred maladies by means of air conditioning, outlining results of tests in which air conditioning equipment was used to retard and relieve suffering from hay fever and pollen asthma.

No. 2929. INSTRUMENTS: C. J. Tagliabue Mfg. Co., 5[illegible] Park Ave., Brooklyn, N. Y. 64 p. catalog (1060D) of "Tag" indicating, recording, and controlling instruments for temperature and pressure. In addition to a new line of recording thermometers and recording pressure gages with 10 and 12 in. charts, complete data are included on indicating and recording controllers, which are available in "on-off" models for ordinary applications or throttling models for use where any considerable apparatus lag is encountered.

No. 2930. METALLIC INSULATION: American Flange & Mfg. Co., Inc., Radio City, New York, N. Y. Bulletins and data sheets on "Ferro-Therm" metal insulation including descriptive bulletin on advantages, showing typical details, specifications, etc.; a reprint discussing fundamental principles and technical background of "massless" type insulators with large air spaces and metallic surfaces of low emissivity; and a reprint on effectiveness of metallic insulators as heat ray traps.

No. 2931. MOLYBDENUM: Climax Molybdenum Co., 500 Fifth Ave., New York, N. Y. Issue of "The Moly Matrix" (Vol. 5, No. 7) including article on molybdenum cast and wrought steel for low temperature service, describing valves with bodies made of this steel to operate at minus 150 F.

No. 2932. NICKEL CAST IRON: International Nickel Co., Inc., 67 Wall St., New York, N. Y. 8 p. booklet of nickel cast iron data (Section 1, No. 1) comprising a guide to the selection of engineering specifications for grey cast iron to secure various properties.

No. 2933. PROCESS CONTROL: Bristol Co., Platts Bridge, Waterbury, Conn. 16 p. bulletin (511) on system of coordinated process control for application to any plant process for which the exact schedule of operation for best overall results is known. The equipment and its applications are described and many different uses are discussed.

No. 2934. PUMPS: Allis-Chalmers Mfg. Co., Milwaukee, Wis. 32 p. bulletin and data book (1653) on "SSUnit" close coupled centrifugal pumps covering a range of 10 gpm against 10 ft head to 1600 gpm and 120 ft head, and for lower capacities up to 300 ft head. It includes capacity tables showing ratings obtainable and recommended motor sizes and speeds for various ratings. Single suction base mounted pumps suitable for v-belt, flat belt or direct connection to gasoline engines or steam turbines are also described and dimension sheets and useful data are given.

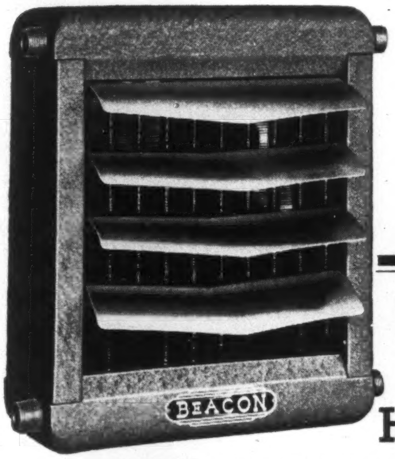
No. 2935. RADIATOR VALVES AND AIR ELIMINATORS: Gorton Heating Corp., Cranford, N. J. 4 p. bulletin (107) describing equalizing valves for radiators and air eliminators for mains. A new equalizing valve with a high venting capacity is included.

No. 2936. RELAYS: Sigma Instruments, Inc., Belmont, Mass. Data sheet (3) on sensitive relays embodying special design features for use in electronic and delicate control applications. Details are described and characteristics are given.

No. 2937. STAINLESS STEELS: American Rolling Mill Co., 703 Curtis St., Middletown, Ohio. 16 p. booklet on heat resisting grades of "Armco" stainless steel, two of which will resist destructive heat scaling at temperatures as high as 2000 F. A typical analysis, average physical properties, information on service at elevated temperatures, and recommendations for handling these steels are presented.

No. 2938. STEAM PLANT EQUIPMENT: Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa. 12 p. bulletin (G-1304) giving a condensed description of the "Yarway" line of steam plant equipment, including various types of valves, water columns, water level gages, expansion joints, spray nozzles and steam traps.

No. 2939. TIME SWITCHES: General Electric Co., 1



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ATTRACTIVE NEW STYLING

The new, modern styling now incorporated in the entire line of Beacon Heaters meets every Architectural and Industrial requirement for more attractive heaters.

Highly efficient in Performance, the line embraces a wide range of sizes in capacities from 20,850 Btu. to 318,000 Btu. for steam pressures up to 150 lbs.

Heating elements are of seamless copper and so constructed that all bolts, gaskets and joints are eliminated, thus insuring the greatest possible transfer of heat. Tubes are expanded into fins without solder and have orifice at inlet providing more efficient steam distribution.

Write today for detailed decription and general specifications.

A few desirable territories still available for recognized distributors. Write for franchise details.

BEACON-MORRIS CORPORATION
702 Beacon Street, Boston, Massachusetts

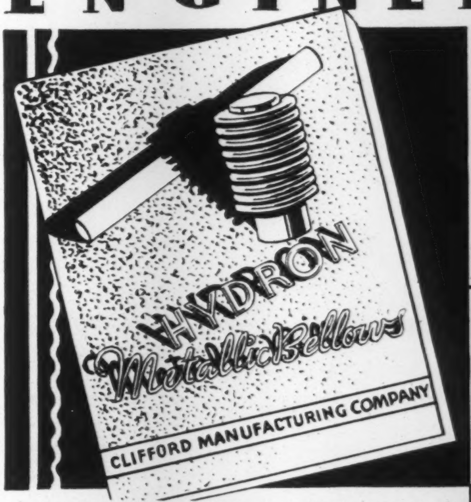
Stop VIBRATION NOISE in Compressor Lines

Rex Vibra-Sorbers absorb vibration, stop noise, insure permanently quiet operation. Sweated into the compressor lines, they act as flexible couplings for speedy, trouble-free installation. All sizes available.

VIBRA-SORBERS

Made by
CHICAGO METAL HOSE CORPORATION
Maywood, Illinois

DID YOU MAKE A NOTE OF THE IMPORTANT ANNOUNCEMENT ON PAGE 22?



ENGINEER'S data book

This COMPLETE ENGINEER'S DATA BOOK CONTAINING 44 PAGES IS NOW AVAILABLE→

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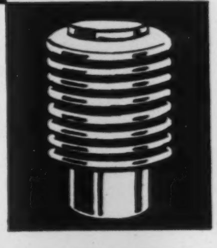

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CLIFFORD MANUFACTURING CO.
BOSTON CHICAGO DETROIT LOS ANGELES
PRODUCERS OF BELLOWS EXCLUSIVELY
SERVING AUTOMATIC CONTROL MANUFACTURERS

FOR YOUR CONVENIENCE

Heating, Piping and Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [9-38]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

1518	1519	1520	1521	1522	1523	1524
1525	1526	1527	1528	1529	1530	1531
1532	1533	1534	1535	1536	1537	1538
2922	2923	2924	2925	2926	2927	2928
2929	2930	2931	2932	2933	2934	2935
2936	2937	2938	2939	2940	2941	2942
2943	2944	2945	2946	2947		

Name.. Title............

Company ....

Address ....

City.. State............

River Rd., Schenectady, N. Y. 4 p. bulletin (GEA-2963) on automatic time switches for control of a-c or d-c circuits. The switches are described in detail and ratings are given.

No. 2940. TURBINES: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 12 p. booklet (B. 2084-A) on "Type C" turbines for mechanical drive, built in capacities ranging approximately from 5 to 500 hp at turbine speeds of 1000 to 5000 rpm. Applications, features, design and advantages are pointed out and tables of specifications are given.

No. 2941. UNIT COOLERS: Fedders Mfg. Co., Inc., 57 Tonawanda St., Buffalo, N. Y. Issue of "Fedders News" (Vol. 5, No. 7) announcing new small unit cooler which has been added to a complete line. Cabinet measures 14 in. wide by 14 in. deep by 15¾ in. high.

No. 2942. UNIT COOLERS: Rempe Co., 340 N. Sacramento Blvd., Chicago, Ill. 40 p. bulletin and price list (105) on units for low temperature cooling and for comfort cooling. The units—of which there are 336 available—are of streamline design, and the bulletin contains engineering data and practical information on selecting the correct unit, sample problems and solutions, tables of air velocities, Btu requirements for cooling, heat leakage, performance ratings, etc.

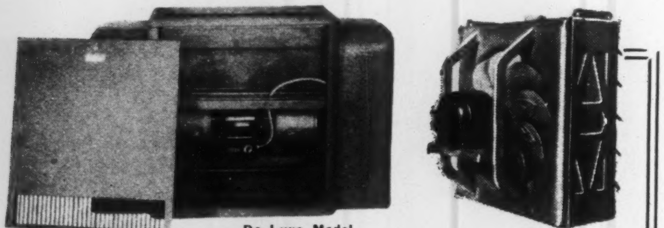
No. 2943. UNIT HEATERS: Beacon-Morris Corp., 702 Beacon St., Boston, Mass. Circular describing new streamlined unit heaters for schools, colleges, hospitals, institutions, office buildings, factories, garages and stores, available in a wide range of sizes for steam pressures up to 200 lb.

No. 2944. UNIT HEATERS: Carrier Corp., Syracuse, N. Y. 4 p. folder giving complete ratings, prices, speeds, constants and dimensions for line of unit heaters, presented in tabular and graphic form. Also a 4 p. folder announcing gas fired unit heaters in three sizes ranging from 70,000 to 210,000 Btu, and including specifications.

No. 2945. VIBRATION CONTROL: Korfund Co., Inc., 48-15 32nd Pl., Long Island City, N. Y. Looseleaf engineering data book with technical data on "Vibro-Isolators" of various types and "Seismo-Dampers," with installation drawings and data on selection.

No. 2946. WELDING ELECTRODES: Metal & Thermit Corp., 120 Broadway, New York, N. Y. 32 p. pocket size pamphlet on "Murex" heavy coated electrodes, with data on physical properties and chemical analysis of the weld metal deposited by each of the 20 odd electrodes in the line.

No. 2947. WINDOW VENTILATORS: Berger Mfg. Co., Div. of Republic Steel Corp., 1038 Belden Ave., Canton, Ohio. 6 p. bulletin on "Silentaire" window units for ventilating, filtering, circulating and noise elimination.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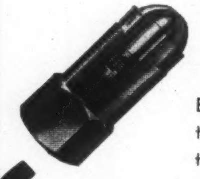
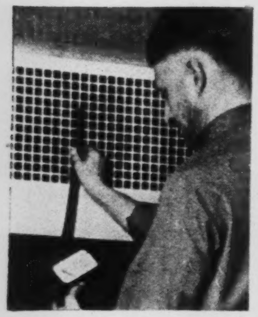

¼" Fig. F-27
MONARCH
SPRAY NOZZLES
Both nozzles illustrated are used extensively for air conditioning units as they produce the finest spray possible with direct pressure. Capacities start at .57 g.p.h. at 40 lbs. Most popular size produces 2.25 g.p.h. at 25 lbs. and very wide (120°) angle spray.

¼" Fig. H-261
CATALOG 6-A
MONARCH MFG. WKS., INC.
2728 E. WESTMORELAND ST., PHILADELPHIA, PA.

CHECK YOUR HEATING INSTALLATIONS WITH THE

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CHAP. 5—The Psychrometric Table and Chart
CHAP. 6—Humidity Controllers and Control
CHAP. 7—Heat Transmission Through Barriers
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CHAP. 9—Heating Systems
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CHAP. 13—Refrigeration Compressors and Condensers
CHAP. 14—Refrigeration Evaporators and Auxiliaries
CHAP. 15—Record Forms for Heating and Cooling
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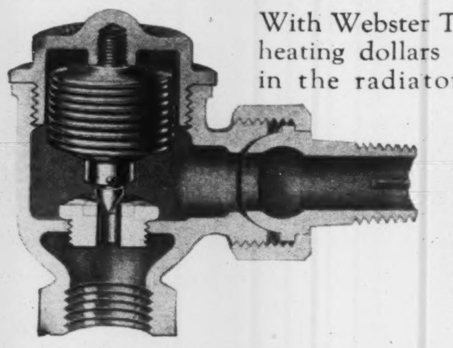

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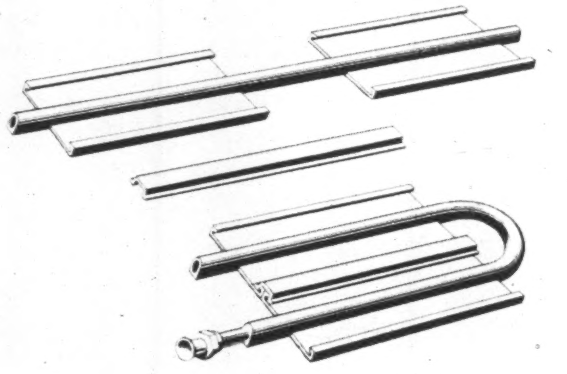
For your convenience in obtaining more information about any of this equipment, see coupon on page 128. Add the new products and companies listed here to your Directory Section which you received in your January, 1938, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Extruded Cooling Coil

No. 1539*—By an ingenious method of using continuous extruded flanged tubing, two cooperating manufacturers have developed a cooling coil with a number of advantages. Since the tube for the refrigerant is integral with the flange forming the cooling surface the heat transfer efficiency is at a maximum, it is stated. Because of the methods used in forming the coil by bending the extruded tube and flange into a continuous unit, the cost of manufacture is reduced.

Weight is saved by the use of the continuous strips of extruded flanged tubing. The strips are bent to form the tube in a 180 deg arc at the extremities of the coil as shown in the illustration. The flanges are brought into parallel contact with each other and locked together with a metal clip in such a way that a continuous flat surface is formed on the inside or cooling surface.



The coil has been tested without sign of breaking, bulging or other form of distortion up to 2800 lb per sq in., according to the maker. This ability to withstand high pressures makes it possible to greatly increase the number of uses for which the coil is suitable. It can be employed for instance in the manufacture of steam tables operating under a high pressure head just as readily as for low pressure circulation of a refrigerant. It is suitable for use wherever it is necessary to transfer heat or cold from a flowing material to a flat surface.

For use in the manufacture of evaporators of large sizes the extruded strips of flanged tubing are available in lengths up to 80 ft or more. In lengths over 21 ft the flanged tubing is supplied in coils. The material employed is an aluminum alloy. At the terminals of the aluminum tubing, copper tube is welded to take the pipe unions used to connect the evaporator with the refrigerant supply lines and if flared union connections are undesirable, the copper ends permit the practice of silver soldering or brazing to headers or supply lines.—Bohn Aluminum and Brass Corp., 2306 Franklin St., Detroit, Mich.

Heat Regulating System for Intermediate Size Buildings

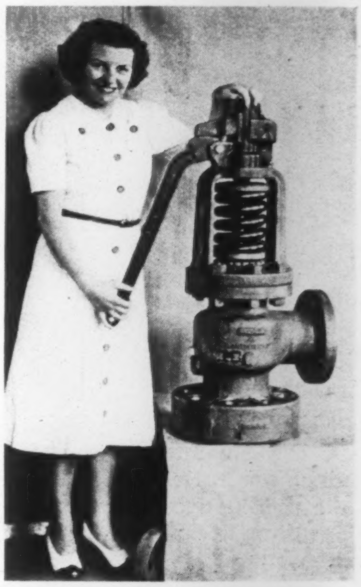
No. 1540—The "Unitrol" heat regulating system has been designed to serve intermediate size buildings—those which are too

large to be served adequately by room thermostats, and which are too small to make an individual engineered system feasible. It is an outside control system, automatically governing inside temperature according to outside weather conditions. Operation is periodical with heating periods lengthened or shortened in accordance with changes in outdoor temperature. According to the manufacturer, its advantages rest in its ability to eliminate overheating or chilling conditions by short on and off periods, in stopping window opening and waste of fuel, and in assuring rapid and even distribution of heat. Further, it permits adjustment to allow for characteristics of individual heating plants and desired heating programs.

The system comprises an outside temperature bulb, a capillary to carry the "message" of outside conditions from the bulb to the control cabinet, and the "Unitrol" which receives the impulse from the outdoor bulb, consults the program disc setting for the building requirements, determines the operation required to satisfy conditions, and "sends instructions" to burner, stoker, valve or pump.

The device has adjustments so that it may be set for the conditions of the particular building to which it is applied, such as exposure, peculiarities of heat distribution, and hours of occupancy.—Marsh Tritrol Co., 600 S. Michigan Ave., Chicago, Ill.

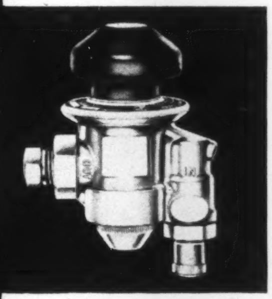
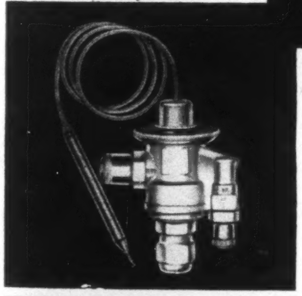
Safety Valve for 2500 Lb Pressure



No. 1541—Completion of a new line of safety valves for elevated pressure and temperature (2500 lb at 1000 F) was announced recently. Special alloy steels with low coefficients of expansion are used for the bodies, bonnets, springs and trim in order that the valves will provide the same performance at these conditions as is regularly produced in safety valves for 300 lb boilers.

Bodies and bonnets are assembled with through bolts to prevent "freezing" at high temperatures. Constant seat diameter is insured by a new type of bevel seat in which the actual contact bearing between the seat and disc is always at the lowest portion of the seat surface, according to the manufacturer.

These new valves will be installed on the highest pressure commercial steam boiler ever

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- Room Unit Coolers
- Beverage Coolers
- Water Coolers
- Serum Cabinets
- Frozen Food Venders
- Refrigerated Display Cases
- Other Small Tonnage Units

● New A-P Model 206 Thermostatic Expansion Valve *(Fixed Superheat)*

New A-P Model 204 Automatic Expansion Valve ●

● New A-P Model 207 Thermostatic Expansion Valve

Manufacturers, Jobbers and Service Engineers—all have welcomed these three new A-P Expansion Valves with enthusiasm! For they bring typical A-P Valve Dependability and Efficiency to the *small tonnage units*—from ¼ H. P. and up—for original equipment or replacement.

Brass Forged Bodies — Large Area Diaphragm — Self-Aligning Stellite Needle — Stainless Steel Seat — Fast, Smooth, Accurate Operation — these and all other well-known A-P features are now offered for the first time in New A-P Expansion Valves for fractional tonnage refrigeration! And the same "trouble-free service", so long a part of A-P equipped installations, is now extended to all applications *large and small!*

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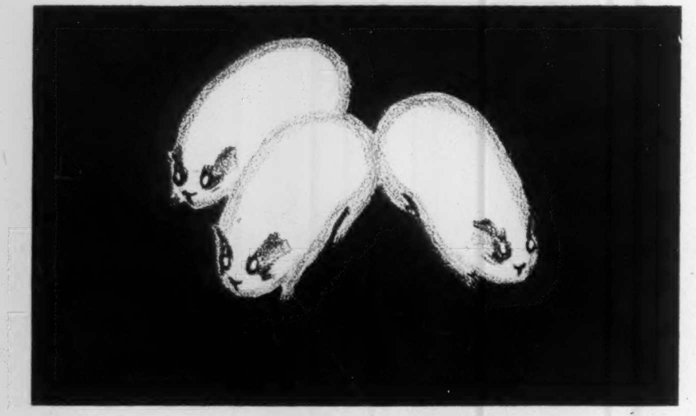

DON'T BE A GUINEA PIG

GUINEA pigs are used the world over as victims of experiments. But you won't learn much from a guinea pig buried underground. Let some other fellow take the chances of experimenting with unproved underground steam conduit. YOU play safe — stick to Ric-wiL!

Ric-wiL Conduit for steam power and heating lines is a sectional system built of vitrified glazed Tile (or of SuperTile or Cast Iron for heavy duty). Standard insulation is patented Dry-paC Waterproof Asbestos—other hand-packed insulation or sectional pipe covering optional. Ric-wiL with Dry-paC delivers more than 90% efficiency on the line. Interlocking construction joins upper and lower halves of conduit, also end joints of conduit and base drain. Exclusive Ric-wiL features secure proper drainage and closed construction—a solid, durable, dependable, underground structure. Interesting studies gladly furnished—on almost any type of job you request.

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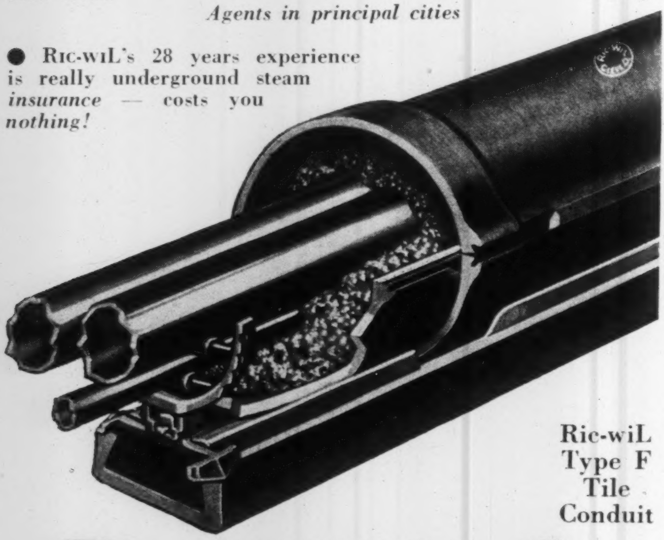
● RIC-WIL's 28 years experience is really underground steam *insurance* — costs you *nothing!*



Ric-wiL Type F Tile Conduit

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CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

built in this country, over 2000 lb W.S.P.—Consolidated Safety Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Room Conditioners for Year Around Service

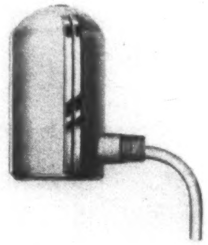
No. 1542**—The "Bruce" room cooler is offered for use in offices, hospitals, small cafes, clubs, beauty parlors and similar spaces and—according to the maker—will cool and dehumidify a room of from 2500 to 3600 cu ft and normal exposures. It uses ice and has six patented heat exchangers or ice containers which together contain 300 lb of ice over which filtered air is forced.

Winter time humidifying is accomplished by placing in the unit three specially designed humidifying pans after first removing the six ice containers. According to the maker, the air is directed in such a way over the water pans that the unit will evaporate from 4 to 6 gal of water a day, depending upon the temperatures and the outside humidity.

A novel feature of the unit is a beverage or utility cold storage compartment.—Industrial Air Conditioning Co., Inc., 1317 Glenwood Ave., Minneapolis, Minn.

New Air Valve Offered

No. 1543—New "No. 73" air valve is available in ⅛ in. angle pattern, ⅛ in. or ¼ in. straight pattern, and ¾ in. male straight pattern with ⅜ in. female tapping in connection. It is of double-shell construction, air being vented into the compartment formed by this shell where it expands and leaves noiselessly through seven small vents in the radiator side of the outer shell. According to the maker, use of seven ports instead of a single port eliminates all noise.

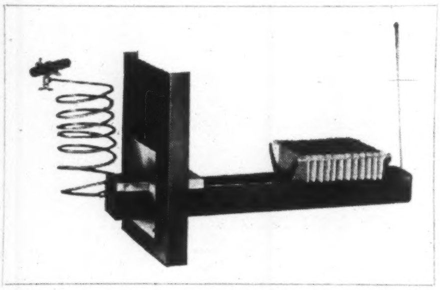


Other features are a large float chamber, a syphon pipe which will fit into narrow radiators, and large venting capacity, it is stated. The venting rate is changed by turning the indicating screw on the top.

Body is satin aluminum with ribs polished and high lighted.—Jas. P. Marsh Corp., 2073 Southport Ave., Chicago, Ill.

Small Humidifier Offered

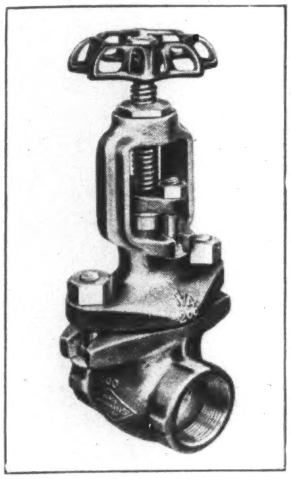
No.1544**—Only 4 in. wide by 3 in. deep, the humidifier illustrated can be fitted into warm air plenum chambers, ducts and cabinets where minimum space is available, according to the maker. It is regularly made in lengths of 20, 30 and 40 in. and special lengths can be supplied where the required quantities justify it.



The unit is automatically controlled by a valve and float assembly and has evaporator plates of fireproof absorbent material. The plate rack holds 12 of the plates suspended in the water but out of contact with sediment deposits which may form in the evaporating pan.

Connection is made to the water line by a special saddle valve assembly, or fluid connection, with three line contact so that it will not crush copper water tubing.—Air Conditioning Supply Co., 4060 Superior Ave., Cleveland, Ohio.

Corrosion Resisting Stainless Steel Valves

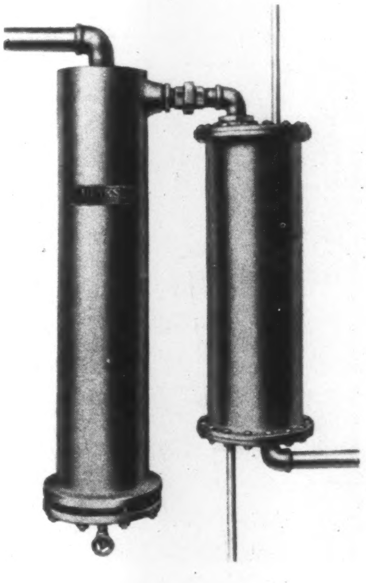


No. 1545—New corrosion resisting stainless steel valves are regularly made of Cooper 18-8 S and Cooper 18-8 SMO, each having a carbon content limited to a maximum of 0.10 per cent (1/10 of one per cent). Both are highly resistent to corrosion, but Cooper 18-8 SMO is used under most severe conditions and is particularly adapted to sulphite pulp mills. These two alloys will take care of almost 90 per cent of all corrosion resisting requirements, according to the maker. In cases where neither of these valves can be recommended, valves of other alloys will be considered on special order.

They are available in seven different styles:—Solid wedge or double disc gate valves, union bonnet or bolted bonnet regrinding globe or angle valves, and bolted bonnet "Y" valves; all either screwed or flanged, in sizes ½ to 3 in.—Jenkins Bros., 80 White St., New York, N. Y.

Precooler for Air Lines

No. 1546—A new precooler for extraction of moisture from plant compressed air lines has outside shell dimensions 15 in. in diameter and 36 in. long. The inside of the shell is partially filled with air tubes so that the heated air goes through them and is cooled by the circulation of water around the tubes at a minimum rate of 2 gpm. The cooling of air causes it to deposit moisture which is collected by a main line oil and water trap which directly follows the precooler. Surplus cooling water is piped to a sewer.



The unit will take care of 200 cfm of air. Inlets and outlets in both precooler and extractor are for 2 in. pipe. The extractor is 45½ in. high, 8¾ in. in diameter, and is equipped with ⅜ in. drain cock.—Binks Mfg. Co., 3114-40 Carroll Ave., Chicago, Ill.

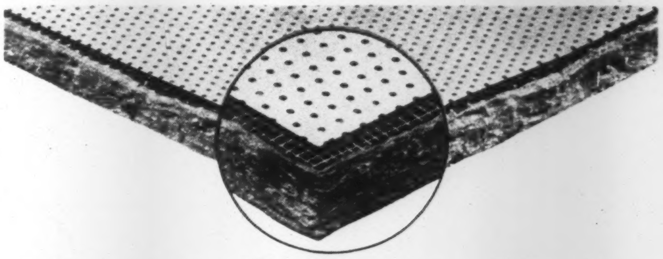
Room Ventilator and Filter

No. 1547*—Positive ventilation and circulation throughout a room, all year 'round is provided by a new room ventilator. Outdoor noises, dust and pollen are banished from the office or home, the maker states. The air that is brought in by the two aerodynamic fans is filtered over and over again as it is recirculated. The deluxe model permits air to be directed up or down at any angle.

A finger tip control enables any desired amount of air to be brought into the room so that during the heating season just enough air may be introduced to keep the room air fresh. The recirculating feature distributes the heated air evenly throughout the room.

"Quiet as falling snow"

That results from using Acousti-Pad for duct lining



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● You are sure to avoid customers' complaints about duct noise if you use Burgess Acousti-Pad for duct lining. It blots up noise as easily as a blotter absorbs ink.

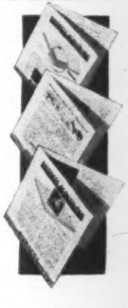
Acousti-Pad is a patented duct lining constructed on the famous Burgess principle of noise absorption. Both tests and experience have proved its effectiveness under severe conditions.

You install Acousti-Pad easily and quickly as the duct is fabricated. Its advantages include fire resistance and complete freedom from odors. The smooth metal facing offers no resistance to air flow.

You will find it easy to determine the correct amount of Acousti-Pad for each job. You can use the simplified Burgess data sheets which give you direct readings of footage required.

Adopt the safest way of avoiding unexpected duct noise. Include Burgess Acousti-Pad in your specifications. Get information on installation methods, prices, and source of supply. Write to us. Ask for the Duct Quieting Bulletins.

Write for Bulletins



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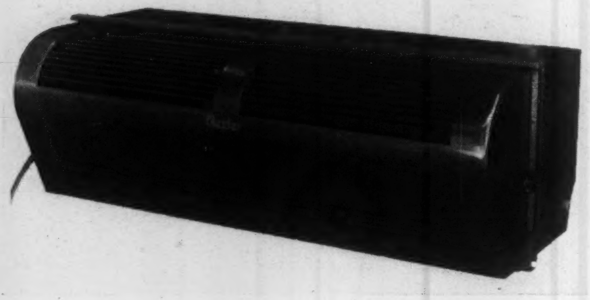
BURGESS ACOUSTI-PAD

FOR ABSORBING DUCT NOISES
IN AIR CONDITIONING SYSTEMS



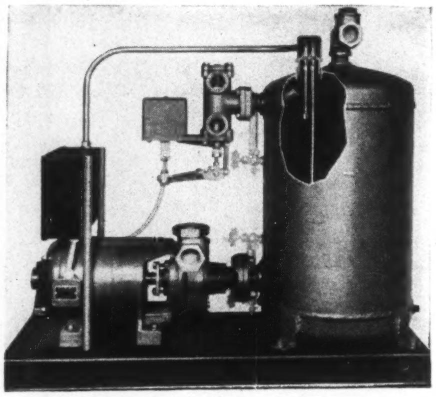
Installation is simple. The side panels are quickly fitted between the ventilator and the window frame and the unit is then plugged in to the nearest electric outlet.—Carrier Corp., Syracuse, N. Y.

Self Contained Boilerfeed Pump Unit

No. 1548*—New "pressure equalizing" boilerfeed pump employs the basic principle of first equalizing the pressure in the receiving chamber of the pump unit before pumping its contents into the boiler.

As soon as the receiver is filled a valve is automatically opened to admit boiler pressure to the receiving chamber. Simultaneously the pump is started and operates until the contents of the receiving chamber are pumped into the boiler. The equalizing valve is then automatically closed and the pressure vented from the receiver so that condensate may again flow into it.

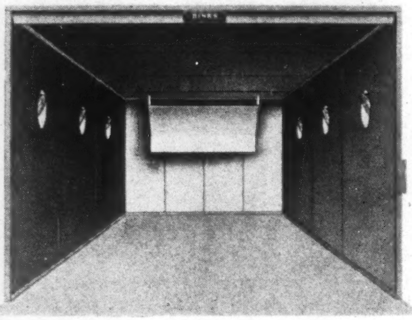
Two advantages are said to be gained by this method of operation. (1) By equalizing the pressure it is necessary merely to pump against the static head of the boiler and therefore a low head centrifugal driven by a low powered motor can be used; in the unit for handling a 150 hp boiler, for instance, only a 1 hp motor is used. (2) By keeping the condensation delivered to the centrifugal pump under boiler pressure through the equalizing principle, the condensate can be handled at a higher temperature with a consequent gain in boiler efficiency.



Available for boilers up to 150 hp with working pressures up to 125 lb.—The Johnson Corp., 830 Wood St., Three Rivers, Mich.

Auto Spray Booths

No. 1549—Institutions which operate a fleet of trucks, or cars, which must be maintained will be interested in a new line of auto spray booths. Designed in units for flexibility of application, the user may purchase only top and one side or a top and two sides, or a top, back and one side, and thus utilize his own walls as part of the booth.



1 2 3 4 5 6 7 ⑧ 9 10 11 12 13 14 15

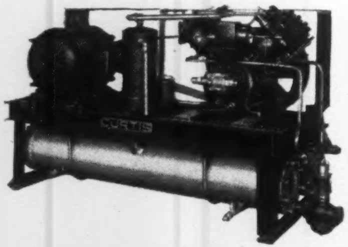
No. 8 of a Series of Curtis Advanced Engineering Features.

CURTIS Piston Pin Clamps Prevent Wear and Reduce Vibration

A small yet important detail, is the Curtis practice of using a split connecting rod with clamp lock construction that holds the pin in perfect alignment. This effectively prevents undue movement of the pin, reduces wear on pin and cylinder wall, lessens noise and vibration. The Curtis pin itself is hollow, of heat treated alloy steel, ground to precision limits.

Such engineering refinements and attention to details have made possible the Curtis record of trouble-free, efficient and economical performance — proven year after year in thousands of installations. There's a Curtis compressor and condensing unit for every requirement, from 1/6 h. p. to 30 h. p.

Write to Curtis today for complete information.



CURTIS

"Builders of Condensing Units Since 1922"

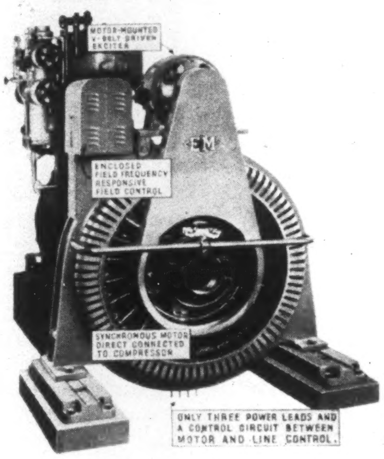
CURTIS REFRIGERATING MACHINE CO.

Division of Curtis Manufacturing Co.

1950 KIENLEN AVENUE ST. LOUIS, MO.

These auto spray booths are constructed of 22 ga sheet steel sectional panels, reinforced with 2 in. x 1½ in. x ⅛ in. angle steel frame, spot welded. Top, back, right or left side exhaust can be furnished.—Binks Mfg. Co., 3114-40 Carroll Ave., Chicago, Ill.

Synchronous Motor Drive for Compressors


MOTOR-MOUNTED V-BELT DRIVEN EXCITER
ENCLOSED FIELD FREQUENCY RESPONSIVE FIELD CONTROL
EM
SYNCHRONOUS MOTOR DIRECT CONNECTED TO COMPRESSOR
ONLY THREE POWER LEADS AND A CONTROL CIRCUIT BETWEEN MOTOR AND LINE CONTROL.

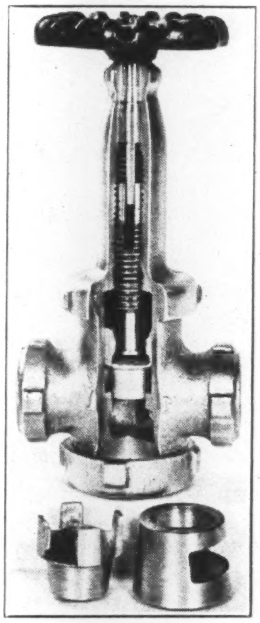
No. 1550—A development that simplifies wiring and installation and reduces floor space required for direct connected synchronous motor drives for reciprocating compressors such as used for refrigeration in air conditioning has been announced. The field control equipment for the synchronous motor, as well as the exciter, is now mounted on top of the motor. The synchronous motor can thus be shipped with all wiring completed between the motor, exciter, and field control. The only wiring required on the job is between the synchronous motor and a line control switch, which can be of a wall mounted full voltage or compensator type.—Electric Machinery Mfg. Co., 1331 Tyler St., N.E., Minneapolis, Minn.

Globe Valves for High Pressures

No. 1551**—New packless "T" globe valve, which has several unique features, has been designed for pressures varying from 150 to 1500 lb and temperatures up to 1100 F. Available in sizes ranging from ½ to 4 in.

Features include patented "all metal against metal" construction, eliminating necessity for the packing gland, packing and packing nut, and the "Veriquick" renewable seat and slip disc of high Brinell metals which can be changed without removing the valve from the line.

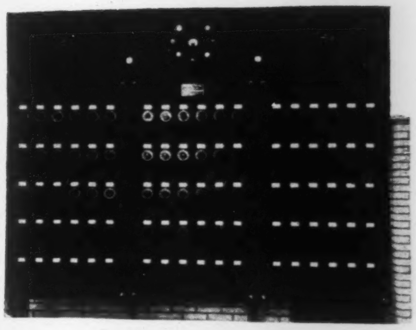
To insert a new seat, the cap is unscrewed from the base, the tapered seat ring is ejected by screwing down on hand wheels, new seat ring is slipped in, the base cap is tightened and the line is ready for service.—Monat Valve and Forge Co., 908 Bessemer Bldg., Pittsburgh, Pa.



Automatic Boiler Water Control

No. 1552—Among the improvements in a line of boiler water control equipment is a re-designed electrode holder which is installed, either in the gage glass tappings by means of "Y" fittings as illustrated, or with equalizing pipe, as conditions suggest. Its purpose is to complete an electric circuit when the boiler water level falls below normal, the water acting as a

TALLMADG
Zoned Controlle
HEATING



A CONTROL BOARD for remote control is supplied for Tallmadge Zoned Heating that tells the engineer what conditions exist in each zone and when to correct them if necessary.

BETTER HEATING AT LESS COST
GIVES GREATER COMFORT
Improves Air Conditioning

WEBSTER TALLMADGE & C
NEW YORK CITY

YOU CAN HAVE
BOTH
IN AIR-MAZE

The two prime essentials of perfect air filtration—(1) positive stoppage of dust, pollen and germs, and (2) practically unrestricted flow of clean, pure air—are *both* yours with AIR-MAZE Permanent, Cleanable Air Filters. For added measure you also get exceptional economy.

The result of more than 15 years' experience in solving air filtration problems, AIR-MAZE employs an unique application of the baffle-impingement principle, through a scientific arrangement of graduated mesh screens, insuring highest efficiency.

AIR-MAZE filters are economical because they need not be replaced during the life of the air conditioning equipment. No maintenance expense except occasional cleaning and recharging with ordinary oil—a simple process. AIR-MAZE panels can be furnished in any reasonable size and shape for any requirement.

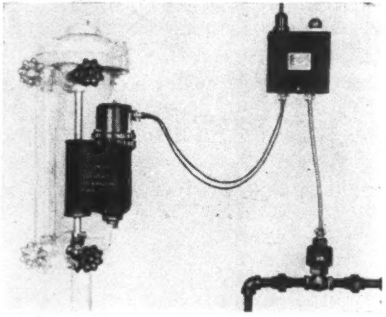
CONSIDER THESE FEATURES

- 99.3% to 99.83% Efficient
- Easily Cleaned, Charged
- Very Low Pressure Drop
- No Replacements Needed

Tell us about your filter problems; no obligation for our recommendations. AIR-MAZE Bulletin PPS-38 is yours for the asking.

AIR-MAZE CORPORATION
5200 Harvard Ave., Cleveland, Ohio

AIR-MAZE
CLEANABLE AIR FILTER PANELS

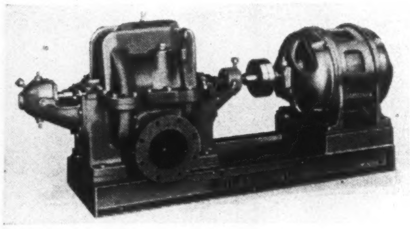


conductor between the two electrodes and the ground to operate an electric feed valve or control a boiler feed pump.

In the new holder the electrodes have the same type of insulation and construction as used in heavy duty internal combustion engines; as a result they will withstand extreme conditions of pressure and temperature, according to the maker. Other improvements have been made in the relay which controls the make-up valve of pump. The introduction of a third electrode provides for a low water cut-out circuit. A wider range of models is now built than formerly. Types include make-up water controls, electric pump controls, and steam pump controls with or without a low water cut-out.—The Johnson Corp., 830 Wood St., Three Rivers, Mich.

Hotwell and Condensate Pump

No. 1553—Improved two stage centrifugal hotwell and condensate pump features oversized suction openings, pick-up type impellers, and generous vents and is offered for efficient removal of condensate under high vacuum, with minimum available submergence.



The casing of the new pump is of cast iron, horizontally split for ready access and removal of the rotor. Suction and discharge nozzles are in the lower half of the casing, while an interstage passage is cast integral with the upper half of the casing. A liberal sized vent is provided to permit escape of entrained vapor.

Bronze impellers, of the single suction enclosed type, designed especially for hotwell and condensate service, are mounted on the shaft with the suction openings facing inward. The back, or discharge, sides of the impellers are thus adjacent to the stuffing boxes, so that the latter are under first and second stage discharge pressures respectively, preventing leakage of air into the pump.—Worthington Pump and Machinery Corp., Harrison, N. J.

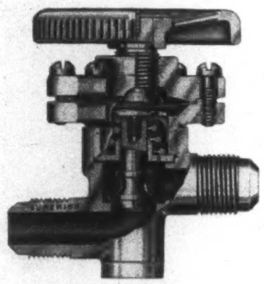
Chart Combines Pipe Design Data

No. 1554—The "Dial-O-Chart" is an attempt to combine in a convenient form the large amount of dimensional data and A. S. A. standards required to design, draw and bill material for a modern high pressure piping system. In addition, the design of expansion bends and pipe stresses are covered in unique manner and the accompanying instruction booklet discusses this part of the chart in detail and gives a short chapter on fundamentals of expansion bend design and calculations of forces and stresses caused by expansion.

The chart represents a gradual evolution from a simpler previous chart which covered butt welding fittings and dimensional data only. It was not developed as a "gadget" but as a time-saving tool and has been used in a preliminary form by the engineering departments of several oil refinery companies. A new edition of the chart on high quality paper has been announced.—Eli G. Shockey, 207 Marguerite Ave., Wilmerding, Pa.

Packless Valves for Refrigeration and Air Conditioning

No. 1555**—Among the features of the new diaphragm packless valve illustrated is a multiple dissimilar metal diaphragm which may be removed for inspection with pressure in the system, pressure cups to isolate pressure from the diaphragm chamber, a bolted bonnet to facilitate removal of the diaphragm, readily removable internal parts for soldering lines to valve connections, and an unrestricted flow area equal to or in excess of line sizes.

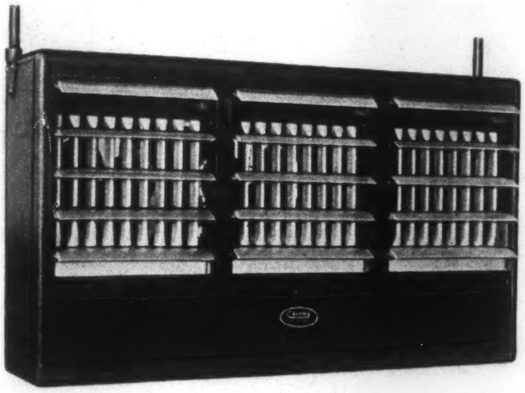


This valve was designed especially for use in refrigeration and air conditioning systems, using methyl chloride, sulphur dioxide, "Freon-12," and similar refrigerants, and is available in two and three way types, sizes 1¼ to 1½ in. inclusive. The valve is only 3½ in. high when fully opened and may be installed in standard metal junction boxes. After assembling and testing the threads and flare seats are fitted with lead flare protectors and the valves are individually boxed.

The same manufacturer also offers a line of refrigeration and air conditioning fittings.—Superior Valve and Fittings Co., 500 37th St., Pittsburgh, Pa.

Gas Fired Unit Heaters

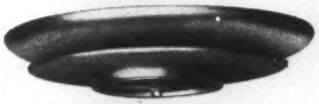
No. 1556—A new line of gas fired unit heaters available in three sizes ranging from 70,000 to 210,000 rated Btu. per hour output supplements the maker's steam and hot water units. In connection with this development a gas fired duct heater for use with central fan air conditioning systems is also offered.



The units are available in one fan, two fan and three fan types, having air deliveries of 1300, 2600 and 3900 cfm, respectively. They are of attractive design with aluminum painted louvers and soft tones of wrinkle finish midnight blue. Compact and for ceiling suspension, they take no floor space and allow ample head room.—Carrier Corp., Syracuse, N. Y.

Air Distribution Outlets

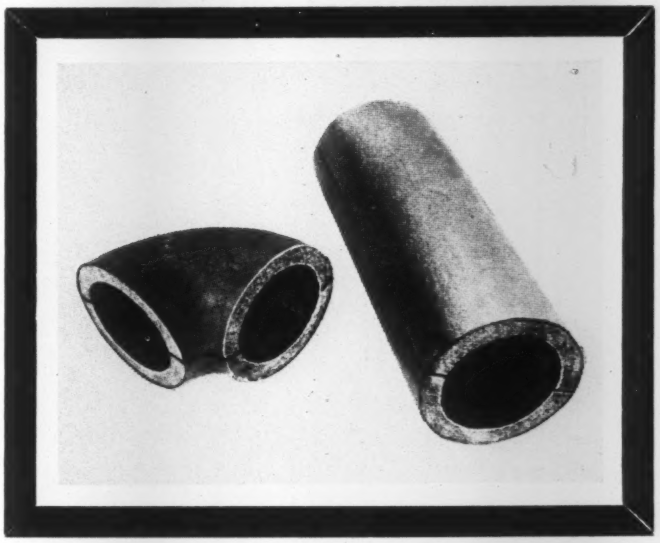
No. 1557—New "Venturi-Flo" air distribution outlets are offered in a wide range of capacities, have no moving parts and are of sturdy construction. According to the maker, they have a high diffusion efficiency and a high



NOVOID CORK

guards pipe lines in

ROCKEFELLER CENTER'S NEWEST BUILDING



AIR CONDITIONING pipe lines in Building No. 7, Rockefeller Center's latest addition, have the efficient and lasting protection of Novoid Cork Covering. This pure cork insulation aids in maintaining uniform temperatures, and helps air conditioning systems operate at maximum efficiency.

Properly installed on circulating lines, Novoid forms an effective barrier to the passage of heat and prevents condensation from forming. It is carefully machined to fit pipes snugly, and moisture-proofed with an asphalt mastic coating.

Novoid Cork Covering and Fitting Covers are available in a wide range of standard pipe sizes. For special fittings, Novoid Fitting Covers can be fabricated to order. Novoid Welding Ell Covers (90 and 45) are made to fit all makes of metal welding ells—long or standard radius. For complete details mail the coupon below. Cork Import Corporation, 330 West 42nd Street, New York City.

NOVOID CORK PIPE COVERING

Mail coupon for full details

Cork Import Corporation
330 West 42nd Street, New York City

Please send me complete information on Novoid Cork Covering for air conditioning pipe lines.

Name ....

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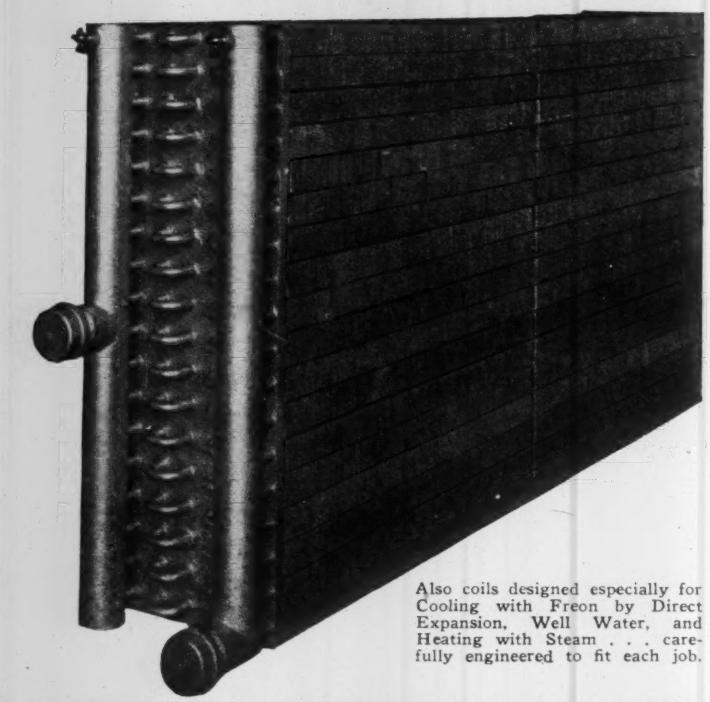
City and State..

BUSH
IR CONDITIONING
COILS



Also coils designed especially for Cooling with Freon by Direct Expansion, Well Water, and Heating with Steam . . . carefully engineered to fit each job.

COIL DESIGNED FOR HEATING WITH HOT WATER

It is made in one section having a total of 2204 square feet of Exposed Surface.

The Face is 64" wide and 38⅛" high. Depth is 12⅝".

It is 18 rows high and 6 rows deep.

The Tube is ⅝" O. D. tinned copper expanded into 2" square Fins spaced 6 per inch.

It was designed for the following conditions:

C.F.M. 8,470
F.P.M. 500
Entering Air 70°
Leaving Air 147°
Hot Water at 180° and 70.5 gallons per minute.
Calculated Load 704,365 B.T.U.'s per hour.

Certain applications of Hot Water heating may require larger Tube and smaller Fins, in which case a 1⅝" Fin on ¾" Tube could be used. With a wide range of Fin and Tube sizes it is always possible to find a combination that will economically fit most conditions.

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BRANCH FACTORY 610 N. OAKLEY BLVD. CHICAGO ILL.

rate of internal mixing which results in quiet and draftless a distribution.

Adapted to all types of heating, ventilating and air conditioni installations, they are available in prime coat, or any of a numb of standard electroplated finishes.—Barber-Colman Co., 2 Loomis St., Rockford, Ill.

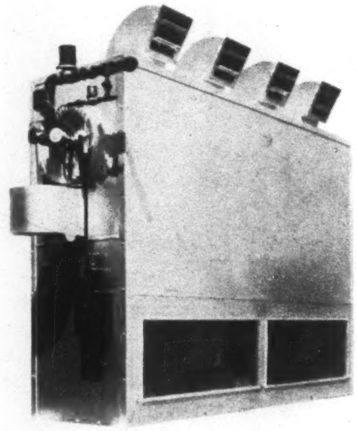
Improved Motorized Valve

MOTORIZED VALVE
MINNEAPOLIS HONEYWELL REGULATOR COMPANY

No. 1558—The improved motorized valve illustrated for hea ing and air conditioning is simple in design, application an adjustment, according to the maker, and has a visible indicator that tells at a glance the valve position. The complete valve comprises three units, the linkage, the motor and the valve itself.

The motor is a capacitor type and the motor and gear train are sealed in oil. A complete range of types is available and two position (on-off) or modulating (throttling) motors can be used. The valve is available for steam, water, gas, oil, or air service in single seated composition disc types, double seated semi-balance types, or fully balanced piston types for high pressures.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn.

Large Capacity Gas Unit Heater



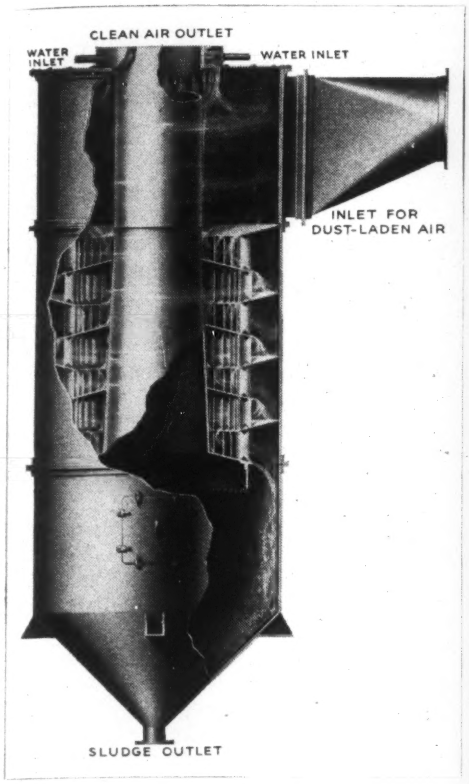
No. 1559—To take care of heating requirements in factori steel mills, finishing mills, assembly plants, foundries, etc., wit large floor areas and high ceilings, a gas-fired unit heater fo operating on manufactured, natural, butane, or propane gas has been announced. It has an input capacity of 1,250,000 Btu per hr and an output of 1,000,000 Btu. Air delivery is 10,000 cfm with an average temperature rise of 125 F. Air velocity is approximately 2500 fpm, making possible a throw of approximately 175 ft with an outlet temperature of 175 to 185 F.

The unit is of the floor type, 3 ft wide and 10 ft 9 in. long. The small width makes it practical to install the heater next to a wall or between colum without taking up a large amount of productive floor space. The unit is 8 ft 3 in. high.

Each of the four air outlets is equipped with horizontal adjustable louvers. Air is circulated by two fans, and a third fa for delivering air to the burner is mounted on the commo shaft, which is driven by a 7½ hp motor.—Surface Combustio Corp., 2375 Dorr St., Toledo, Ohio.

Dust and Fume Suppression System

No. 1560**—The "Hydro-Clone" system of dust and fume suppression has been designed to suppress dust and fumes arisi

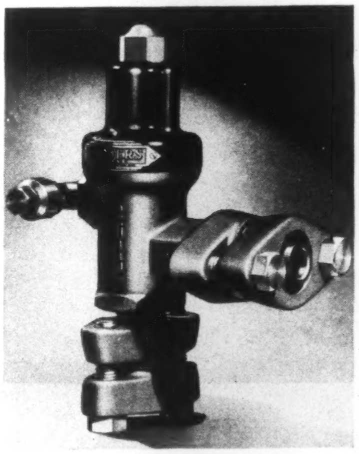


from manufacturing processes and industrial operations. The unit illustrated separates the dust from the air by a combination of centrifugal force and wet impingement and washing. The dust is precipitated in the form of sludge in the de-watering tank which is a part of the system, and the water is recirculated through the "Hydro-Clone" unit.

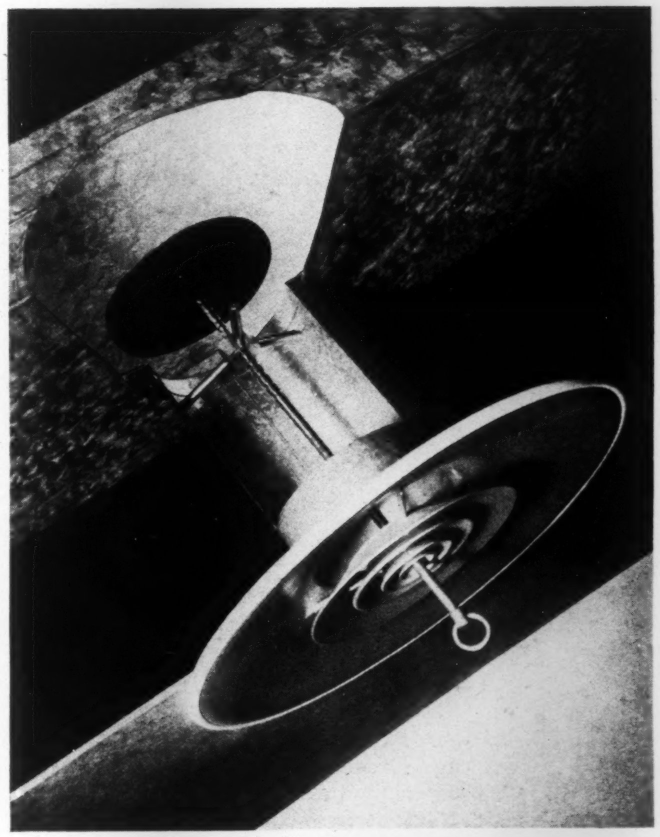
If it is desirable to collect usable dust in a dry form, this dust is separated in the manufacturer's "Dry-Clone" which connects with the "Hydro-Clone" where the fine nuisance dust is suppressed as a sludge. In handling fumes, smoke, fly ash and dust at high temperatures, a combination of the two units is used, the "Dry-Clone" in this case serving as a precooler and a trap for the heavy dust.—Sturtevant Mill Co., Park and Clayton Sts., Dorchester, Boston, Mass.

Constant Pressure and Thermostatic Expansion Valves

No. 1561—The high capacity constant pressure valve illustrated has been designed for use on large commercial refrigeration and air conditioning installations. It prevents the suction pressure in the coil or evaporator from falling below the desired point and makes it possible to maintain this temperature accurately in different evaporators or coils when connected in multiple to the same compressor. By controlling refrigerant pressure within close limits, the manufacturer points out that it prevents the temperature of the room or cooler from dropping too low and prevents coils in unit coolers from frosting over.



The same maker has also announced a new high capacity thermostatic expansion valve for 8, 12, 16 and 20 tons "Freon" capacity. It is designed for use on direct expansion cooling and dehumidifying coils for air conditioning and an exclusive feature is the interchangeable power element bellows and bulb assembly. A convenient hex nut at the top of the valve provides adjustable pressure settings and makes it possible to balance the system.—Fedders Mfg. Co., Inc., 57 Tonawanda St., Buffalo, N. Y.



"ANEMO-TROL"

The Anemostat High Velocity Air Diffuser provides draftless air distribution by mixing room air with conditioned air within the device thus permitting higher velocities and greater temperature differentials resulting in smaller ducts, smaller plants and reduced operating expenses.

The "Anemo-trol" is a scientifically developed damper of the valve seat type especially designed to easily regulate the volume of air distributed through the "Anemostat" High Velocity Air Diffuser. The "Anemo-trol" consists of a "Rubatex" damper plate, reinforced with aluminum disks. This damper plate is regulated by a rod which extends from the damper plate to below the Anemostat. The entire device is held in position by means of three support rods which are fastened directly to the branch duct supplying the Anemostat or to the neck of the Anemostat itself where there is no branch. No air leakage and therefore no "whistling" can occur when the damper is in the closed position. The "Anemo-trol" will not create noise in any position. Made entirely of non-corrosive materials and needing no lubrication the damper requires no further attention after it is installed except regulation.

Complete data available upon request.

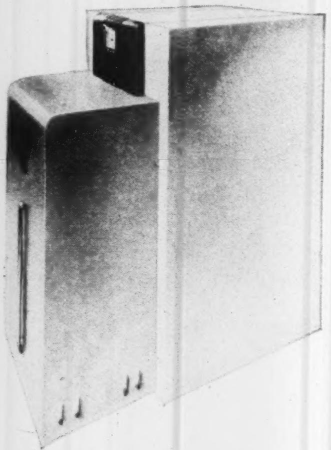
ANEMOSTAT CORPORATION OF AMERICA
10 East 39th Street, New York, N. Y.

ANEMOSTAT
"No Air Conditioning System is better than its Air Distribution"

AN-26-B

FACTORY 810 N. OAKLEY BLVD. CHICAGO, ILL.

That front porch part of the Yello-Jacket, covers an oil burner. If you burn coal or gas, no porch needed. You can shift this boiler from oil to coal, or coal to oil, easier than you might think. You are not tied down to any one fuel.



A NEW
BURNHAM
BOILER
For Your Personal And
Other Now-and-Again Uses

There's some 100 or so of you expert heating engineers that here lately have been using our Welded Steel and Twin Section Boilers quite a plenty for your big jobs.

Yesterday I heard tell of 10 of you who had built yourselves homes since the first of the year. None of you 10 used any of our home heating Burnhams.

Must be it's because you fellers don't know about 'em. What other reason could there be? So this talk I am givin' is aimed at you remaining 90 what maybe home building soon.

When you do, wouldn't it be a smart idea to find out about our new Burnham Yello-Jacket boiler, what stings the fuel bill? Has a fire-shine combustion chamber that runs from its cellar to the garret.

Our folks would be almighty glad to send you printed matter about this Yello-Jacket fuel stinger.

Hank Hindle

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Burnham Boiler

Booklets, Reports and Papers

Air Raid Precautions

At a recent summer special meeting of the (British) Institution of Heating and Ventilating Engineers at Bournemouth A. C. Pallot presented a paper on air raid precautions which has been published in the *Journal* of the Institution, Vol. No. 65. His paper dealt mainly with conditions likely to arise in shelters built to safeguard the civilian population under conditions of aerial bombardment. The control of such matters comes within the scope of the Air Raid Precautions department of the Home Office.

Recommendations for the dimensions, occupancy, quantity of air supply, etc., for such structures have been derived from full scale experimental work and are intended to be such to insure that conditions will not become intolerable after an occupancy period of about six hours. The major problem is to dissipate heat and humidity and it is thought that even in extreme cases no difficulties should arise owing to a deficiency of oxygen or an excess of carbon dioxide. The minimum ventilation rate is stated to be 150 cu ft per person per hr.

The shelters must be substantial to protect against blast and splinters and in effect must be sealed against penetration of gas. For splinter-proof shelters of normal construction, the value of the overall air to air transmissivity of the entire structure is stated to be about 0.3. Design of the ventilation system follows normal practice to some extent, but two alternative main intakes are desirable and these should be protected as much as possible, not placed where heavy concentrations of gas are likely to occur, and not of a type of construction likely to collapse and block the airway. From the intake the air passes through a filter unit, and is then discharged by the fan through the ducts into the shelter. The filter unit comprises a coarse screen of broken coke, metal wool, or other material for removing dust and debris and toxic matter in liquid form, containers of activated carbon, and means of arresting the arsines, which are not held by activated carbon. In addition to electric motor or internal combustion engine drives for fans, the fans are arranged for manual operation by means of pedals or cranks and should have runners of heavy design to give a flywheel effect.

"Rush Treatment" for Hay Fever

A "streamlined" method of treating hay fever sufferers, which telescopes the usual period of treatment from six months down to 10 days, was described to the Air Conditioning Bureau of Boston last month by Dr. Ethan Allan Brown, director of allergy research for the air conditioned Corey Hill hospital in Brookline, Mass., and chief of the allergy department at the New England medical center. Dr. Brown told how he has combined the two best known methods of hay fever relief—medical injection and air conditioning, neither of which is permanent by itself—into a technique which surpasses either in bringing more speedy and certain relief.

The treatment consists of giving patients injections once, twice, or even three times a day in an air conditioned hospital, rather than once a week for a period of six months as was done heretofore without air conditioning. "This enables the patient to leave the hospital during the ragweed season, and yet keeps him comparatively free of symptoms," Dr. Brown said. "The level of immunity is then high, and can be controlled by injections given every three weeks or every month during the rest of the year without returning to the hospital. It is not necessary for the patient to return to the hospital the following year, nor is it necessary for most patients to have further injections."

Stresses Due to Welds in Pipes

Among the papers to be presented at the annual meeting of the American Welding Society later this month in Detroit is a discussion on Residual Stresses Due to Circumferential Welds in Pipes, by E. L. Eriksen and I. A. Wojtaszak of the Department of Engineering Research, University of Michigan. The following is a brief of the paper issued by A. W. S. headquarters:

It is difficult at first glance to imagine why a 2 ft length of pipe with an arc weld in the middle should be under stress or load before any visible load has been placed on it. Yet peculiar residual stresses are created in different parts of a pipe that has been welded. The heat of welding causes the pipe to yield while hot, the yields not being completely reversed during cooling after welding. As a result, the steel in the pipe is under load after welding. These loads or residual stresses have been measured by Eriksen and Wojtaszak, who have also studied the effect of reheating the welds to dissipate the residual stresses.

Since stress is always accompanied by changes, although small, in dimension, the pipes were cut into pieces in several different ways, the changes in dimensions as a result of cutting being caused by release of the residual stresses. The measurements, which were made with microscope micrometers showed that welded joints in mild steel pipes $8\frac{5}{8}$ or 20 in. diameter, $\frac{1}{2}$ or 1 in. thick, may have residual stresses up to 50,000 lb per sq in. in the larger pipe and 25,000 lb in the smaller. Reheating the weld 8 hr at 1200 F reduced the residual stresses nearly to zero. These measurements show that high residual stresses may exist near welded joints in large pipe and prove that the customary "stress relieving" heat treatment is entirely adequate.

The Heated Thermometer Anemometer

C. P. Yaglou of the Department of Industrial Hygiene, Harvard School of Public Health, writes on the heated thermometer anemometer in the October issue of the *Journal of Industrial Hygiene*. The paper describes a new hot wire anemometer operating at low temperature capable of measuring accurately air velocities of 10 to 6000 fpm, which consists of an ordinary glass thermometer with an electric coil surrounding its bulb. Small dry cells furnish the heating current and the voltage is regulated by means of a rheostat, this auxiliary equipment being assembled in a small box. Readings to be taken are temperature of the heated and unheated thermometer and of the voltage used, and the velocity is read from a table or chart, or computed from an equation. By varying the voltage, any velocity can be measured with accuracy.

The instrument is particularly useful for measuring air movement in rooms or in front of exhaust hoods that cannot be measured conveniently or accurately by other methods. The instrument automatically compensates for ordinary variations of temperature and is negligibly affected by humidity, radiant heat and convectional currents of its own. It offers little obstruction to air flow but requires correction for partial stem immersion when used inside small pipes.

Schools and Study Courses

Resident Trade School Course in Air Conditioning

The Jourden Diesel Schools, Inc., operating resident trade schools in Philadelphia, Pittsburgh, Cincinnati and Baltimore, inaugurated earlier this year a program of training in air conditioning which is intended to be an engineering course and is taught as such. Along with the engineering is given laboratory, shop and job experience to allow students to become familiar with the majority of the things taught them in the classroom work.

FULTON
Sylphon
TRADE MARK
FOR
TEMPERATURE
CONTROL

• of Building Zones

Sylphon Electric Valves open an entirely new field of possibility to the architect and heating engineer. With an amazing adaptability to space heat control problems ranging from a single radiator to an entire building—they offer remote-thermostat-controlled, heat-motor-operated valve service at a fraction of the usual cost.

They permit all the multifarious wiring arrangements which include such elements as manually operated remote station switches, electric time switches, indoor-outdoor dual thermostat control, etc. Yet there are no levers, no wearing parts. Nothing to lubricate. No mechanism to adjust. And the system is noiseless.

The unique "heat motor" in the Sylphon Electric Valve is the secret of this valve's operation. Developed by Fulton Sylphon engineers—this "motor" is not literally a motor at all, but is a tiny metal bulb containing a volatile liquid. When warmed by a low voltage current passing through the resistance coil surrounding it, this liquid expands, producing pressure inside a Sylphon Bellows to operate the valve.

Look into this and other modern Sylphon Controls described in the following Bulletins. Ask for your copies.

● Individual Room Temperature Control — Bulletins TE 80 and TE 70 . . . Zone Control—Bulletin TE 70 . . . Space Heat Control in Large Industrial Areas—Bulletins TE 50 and TE 70 . . . Duct Type Heating and Air Conditioning Controls—Bulletin TE 50 . . . Service Hot Water Supply Control—Bulletins TE 20 and TE 40 . . . Drinking Water Temperature Control—Bulletin TE 20.

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KNOXVILLE, TENNESSEE
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The greatest need of the industrial power plant is modernization to cut the present preventable waste of six or seven hundred million dollars yearly in the generation, purchase, internal distribution and application of power services.

Philip W. Swain

Philip W. Swain, Editor of Power

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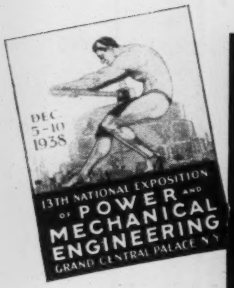
CHALLENGE TO INDUSTRY

Heating, piping and air conditioning engineers face the opportunity of their lives in solving industry's great problem.

Your work is intimately tied in with progress in the generation, transmission and use of power. To be sure of your own future, you must actually see the newest and best equipment, understand its principles and applications, know how to operate it, know where and when to use it. That opportunity is yours at this year's National Power Show—the 13th National Exposition of Power and Mechanical Engineering.

More than 40,000 engineers are expected to attend. Be sure to come. Bring your associates. Don't miss it!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13TH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING
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13TH NATIONAL EXPOSITION
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NEW YORK
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Following an introductory lesson on the field of air conditioning, there is a series of lessons on drafting, blueprint reading and freehand sketching. After this comes a review of mathematics, including simple algebra and the use of the slide rule.

After this preliminary training, the student is introduced to various fundamentals of air conditioning, starting with heat, then gas laws, properties of air, the psychrometric chart, etc. Then the lessons go directly into the study of air conditioning itself, the making of estimates and layouts, etc. After this section of the course, the training of the student in sales engineering, estimating and layout work, or service and installation work, depending on which field he displays the most talent in, is emphasized. The last lessons are devoted to principles of successful sales engineering, further practice in estimating and layout work, and instruction in service and in installation.

Richard Bozeman is chief instructor of the air conditioning division and is responsible for the preparation of the course. His experience includes estimating, service, research, construction, and he has been with various manufacturers and in a consulting engineering office.

Evening Courses in Industrial Air Conditioning, Heat Transfer, Acoustics

Armour Institute of Technology, 3300 Federal St., Chicago, Ill., offers a course on industrial air conditioning, M. E. 507. In this course and its continuation in the second semester, the student will make an application of the principles of air conditioning, heating and ventilating to a practical problem such as meeting the needs of some specific industry, a textile plant, printing plant, or other industrial situations. Six hours a week will be given to it through each semester. Further practice will be given in the course, M. E. 513, with its continuation, 514, in the second semester. Students in this course will be given more advanced problems and will complete three or more designs for selected industries. Professor Henry Nachman is in charge of the work in air conditioning under general direction of the department head.

Physics 507 is the first part of a course in the fundamentals of heat transfer and insulation. It is given by Dr. Max Jakob, former director of the German government's laboratory of thermodynamics and hydraulics, who came to Armour a year or two ago, and who has made the field of heat transfer the subject of original and important investigations, which he is continuing. The theory of heat transfer is, of course, fundamental to the whole question of heating and air conditioning.

Physics 509, under Professor Paul Copeland, covers the theory of vibrating systems and wave propagation, with special application to such applied problems as the acoustics of buildings and the reproduction of sound. All of these courses are of graduate rank and they are usually given to classes sufficiently small to permit of a considerable adjustment to the study of individual problems and interests by the student.

Courses in Chemical Engineering

University College of the University of Chicago is offering evening courses in chemistry in its downtown building at 18 S. Michigan Ave., among which are three on the subject of unit operations of chemical engineering. The first of these is specifically on fluid flow and heat transfer, and covers by lectures and problems the basic laws and their practical applications which confront the chemical engineer. Topics to be discussed include viscous and turbulent flow, metering, prediction of pressure drop, pumps, flow of heat by conduction, convection and radiation, and the application of heat transfer to industrial processes such as evaporation.

The second of these courses is on air conditioning, drying and distillation, and the topics discussed will include humidification and dehumidification of gases, drying of solids and distillation of simple mixtures and liquids. The third of the courses is to cover absorption, extraction, filtration, etc.

The first meeting of the first course was on October 4, the first meeting of the second course will be on January 3, and the first meeting of the third course on March 28.

Book Reviews

New Edition of Air Conditioning for Comfort

["Air Conditioning for Comfort," by Samuel R. Lewis, Consulting Mechanical Engineer, 3rd ed. 1938. 285 + viii pp., 6 x 9 in., clothbound. Published by Keeney Publishing Co., 6 N. Michigan Ave., Chicago, Ill. Price, $2.50.]

This new edition of Lewis' well-known "Air Conditioning for Comfort" has been completely re-written, revised and enlarged and embodies the experience resulting from use of the two earlier editions in almost daily practice and by students in many schools. It will be found valuable as a text for school and home study use, as well as a reference for the contractor, engineer, architect, and owner or prospective owner of an air conditioning system. The author is actively engaged as a consulting engineer in air conditioning work, and is recognized as a foremost authority on the subject.

Use of the book as a school text has demonstrated that the near-enough approximations in examples due to use of a slide rule do not satisfy all requirements, and these approximations have been eliminated. In the examples of psychrometric computations, both the tables and the chart are applied to render both devices thoroughly understandable. The methods and practices suggested throughout are those of a successful engineering office, where every suggestion is tested in the "acid bath" of actual installation and operation.

The book is divided into twenty chapters as follows (those marked with an asterisk are wholly new chapters): Chapter 1—Terms Used in Air Conditioning; Chapter 2—Heat and Air*; Chapter 3—Air Conditioning Standards; Chapter 4—Air Conditioning and the Human Body; Chapter 5—The Psychrometric Table and Chart; Chapter 6—Humidity Controllers and Control; Chapter 7—Heat Transmission Through Barriers; Chapter 8—Ventilation, Solar and Appliance Heat; Chapter 9—Heating Systems; Chapter 10—Air Conditioning Systems; Chapter 11—Air Conditioning Apparatus*; Chapter 12—Refrigeration and Refrigerants; Chapter 13—Refrigeration Compressors and Condensers*; Chapter 14—Refrigeration Evaporators and Auxiliaries*; Chapter 15—Record Forms for Heating and Cooling*; Chapter 16—Air Distribution; Chapter 17—Water in Air Conditioning; Chapter 18—Noise and Its Control*; Chapter 19—Air Conditioning Instruments and Measurements*; Chapter 20—Codes and Operating Suggestions*.

A large psychrometric chart is pasted to the back cover and its use is completely explained in the text.

Theory of Mechanical Refrigeration

["Theory of Mechanical Refrigeration," by N. R. Sparks, Associate Professor of Mechanical Engineering, Pennsylvania State College. 1st ed. 1938. 225+ix pp., 6 x 9 in., clothbound. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y. Price $3.00.]

Professor Sparks deals exclusively with the rational treatment of refrigerating cycles in this new book, which aims to give the student a thorough grounding in the necessary principles and to provide practice in applying such principles to the logical development of all types of refrigerating systems. Because it is the author's belief that most of the purely descriptive matter and empirical data related to a subject is best and most quickly learned during active practice in the field—and not in engineering

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sturdy . . .
quiet . . .
serviceable

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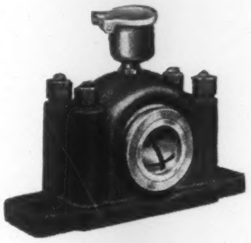
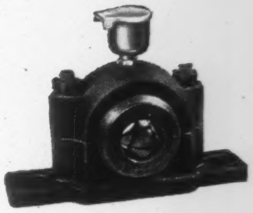


Randall D. R. O. R. Pillow Block — Has a double reservoir.



Randall Universal Pillow Block —Has a double reservoir and can be mounted in any of four positions.

Randall Flange Pillow Block has a double reservoir. For side mounting on unit heaters or cabinet type air conditioners.

The majority of air conditioning equipment manufacturers have standardized on Randall Pillow Blocks for their units. Years of satisfactory service in the field substantiates their decision.

The quiet and trouble free operation of Randall self-aligning and self-lubricating pillow blocks is worth your consideration. If these pillow blocks are not now standard on your equipment write today for our 1938 catalog describing in detail our complete line.

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Father Time—that tough old tester—has a lot of respect for Hussey Pure Lake Copper. He has known it for over 90 years . . . has seen it weather a thousand elements and has come to know it as the metal of eternal youth. And no wonder, when you consider that Hussey is a Pure Lake Copper, fortified by Nature to resist corrosion as no other type of copper can. That is why you will find Hussey Pure Lake Copper a "natural" for modern air conditioning applications—why it is considered a quality specification throughout the industry.

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curricula already hard pressed to instill fundamentals and their applications within the allotted time—such material and data are omitted.

The content of this book is thus confined solely to that necessary for a thorough presentation of the fundamental thermodynamic approach to the subject of refrigeration, excluding such material as may appear elsewhere in works of the handbook type. Chapters are included on basic thermodynamics, principles of refrigeration, the air refrigeration system, the vapor refrigeration system, compound vapor compression systems, solid carbon dioxide, multiple effect vapor compression, the absorption refrigeration system, refrigeration in air conditioning, the water vapor refrigeration system, and a concluding section on other applications. This last section is devoted largely to the heat pump as a heating device.

Conventions and Expositions

National Association of Public School Business Officials: Annual convention, October 10-14, Palmer House, Chicago, Ill.

Silver Jubilee Safety Congress and Exposition: October 10-14, Stevens Hotel, Chicago, Ill. Managing Director and Secretary, W. H. Cameron, National Safety Council, Inc., 20 N. Wacker Drive, Chicago, Ill.

American Welding Society: Annual meeting (in conjunction with Metals Congress Exposition), October 16-21, Book-Cadillac Hotel, Detroit, Mich. Secretary, M. M. Kelly, 33 W. 39th St., New York, N. Y.

Food Preservation Conference: October 20-21, University of Tennessee, Knoxville, Tenn. Sponsored jointly by the University and the American Society of Refrigerating Engineers.

Industrial Unit Heater Association: Fourth regular meeting, October 21-22, French Lick Springs Hotel, French Lick, Ind. Headquarters office, 5-208 General Motors Bldg., Detroit, Mich.

American Public Health Association: Annual meeting, October 25-28, Kansas City, Mo. Headquarters Office, 50 W. 50th St., New York, N. Y.

Refrigeration Service Engineers Society: Annual convention, November 2-4, Hotel Statler, Buffalo, N. Y. Chairman, George E. Wilson, 92 Royal Ave., Buffalo, N. Y.

Power Show: National Exposition of Power and Mechanical Engineering, December 5-10, Grand Central Palace, New York, N. Y. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

American Society of Refrigerating Engineers: Annual meeting, December 6-8, Hotel Commodore, New York, N. Y. Headquarters office, 37 W. 39th St., New York, N. Y.

National Warm Air Heating and Air Conditioning Association: 25th anniversary convention, December 12-14, Netherland-Plaza Hotel, Cincinnati, Ohio. Managing Director, Allen W. Williams, 50 W. Broad St., Columbus, Ohio.

Refrigeration and Air Conditioning Accessories Exhibition: January 16-19, Stevens Hotel, Chicago, Ill. Manager and Committee Secretary, R. M. McClure, 111 W. Washington St., Chicago, Ill.

American Society of Heating and Ventilating Engineers: Annual meeting, January 23-26, William Penn Hotel, Pittsburgh, Pa. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

American Society of Refrigerating Engineers: Spring meeting, May 22-23, Hotel Hershey, Hershey, Pa. Headquarters office, 37 W. 39th St., New York, N. Y.

Smoke Prevention Association: Annual convention and exhibit, June 13-16, Hotel Schroeder, Milwaukee, Wis. Headquarters office, 139 N. Clark St., Chicago, Ill.

International Acetylene Congress: 13th International Congress of Carbide, Acetylene, Oxy-Acetylene Welding and Allied In-

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That the Singer Bldg., New York, chose wisely when they installed Patterson Hot Water Heaters is demonstrated by the fact that, after many years of service, their heaters are still delivering all the hot water required, as hot as required and as quickly as required.

It takes experience to furnish a dependable hot water supply for such a large building. Patterson - Kelley engineers have had more than half a century of experience.

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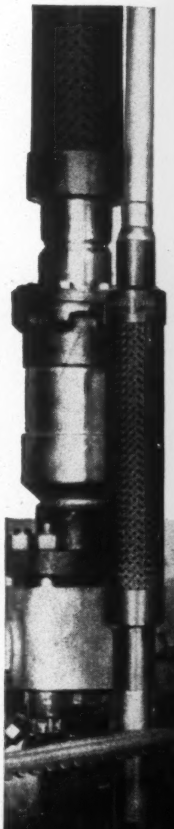
Stop VIBRATION NOISE in Compressor Lines



Rex Vibra-Sorbers absorb vibration, stop noise, insure permanently quiet operation. Sweated into the compressor lines, they act as flexible couplings for speedy, trouble-free installation. All sizes available.

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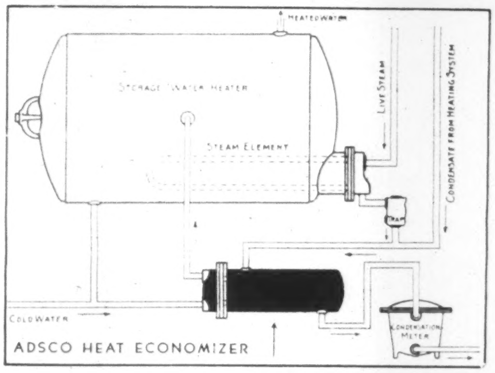

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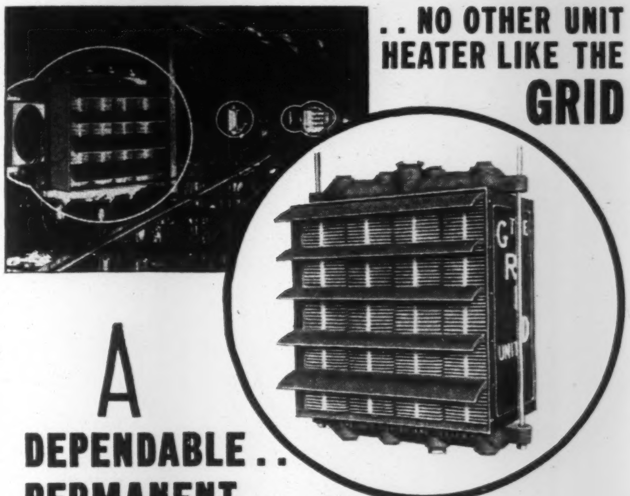

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Wood filling . . . spray distribution . . . zig-zag drift eliminators . . . Multi-blade fans. Suitable for all refrigerating or air conditioning loads up to twelve tons capacity. Carried in stock for immediate shipment. Write for Bulletin No. 502.

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WATER COOLING SYSTEMS

dustries, June 25-July 1, Munich, Germany. International Acetylene Association, 30 E. 42nd St., New York, N. Y.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 128. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 2948. AIR CONDITIONING FOR INDUSTRY: Carrier Corp., Syracuse, N. Y. 12 p. catalog showing extent of equipment available to serve industry for air conditioning, refrigeration and space heating. Carefully indexed, the publication includes illustrations, diagrams, dimensions, application, operation, installation and other data for quick reference by plant engineers.

No. 2949. BOILER WATER LEVEL CONTROL: McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill. Series of eight leaflets on boiler water level control equipment, including low water cut-off, pressure limit control, electric water feeder, high pressure low water cut-off, conversion mechanism, etc. Also contractor's discount and net price sheet.

No. 2950. BRAZED JOINTS: Walworth Co., 60 E. 42nd St., New York, N. Y. 13 p. booklet on refrigeration and air conditioning with brazed "Walseal" joints covering the use of these valves, fittings, flanges, headers and special parts in air conditioning and refrigeration. Included are suggested installation layouts for direct and indirect cooling, a detailed section of instructions and technical data on how to incorporate brazed connections into air conditioning piping layouts, and other information.

No. 2951. COLD DIFFUSERS: Carrier Corp., Syracuse, N. Y. 4 p. folder (CR-121) describing cold diffusers available in sizes to deliver from 200 to 11,000 cfm and in a range of 1/10 to 35 tons refrigeration capacity.

No. 2952. COMBUSTION CONTROL: Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, Ohio. 32 p. bulletin (102-B) describing application of steam flow-air flow automatic readjustment type of air operated combustion control. In addition to describing and illustrating various elements of the system, the bulletin explains fundamental principles involved in controls both for stoker fired boilers and for boilers fired with fuels in suspension.

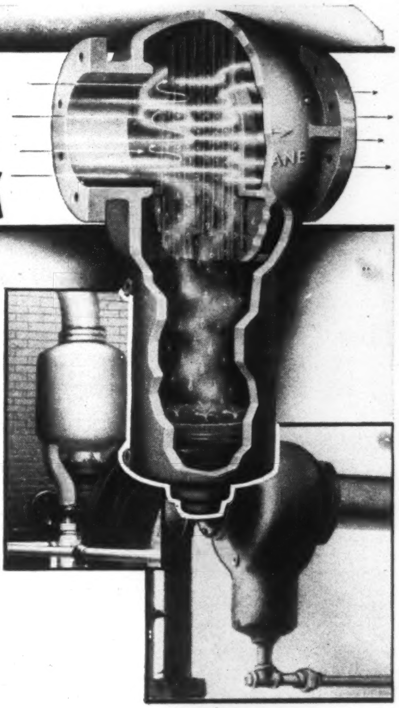
No. 2953. CONDENSING UNITS: Carrier Corp., Syracuse, N. Y. 6 p. folder (CR-120) on condensing units built in sizes from 1/4 to 50 hp, giving specifications for the various sizes.

No. 2954. CONTROLS AND EQUIPMENT: Detroit Lubricator Co., 5900 Trumbull Ave., Detroit, Mich. 36 p. condensed catalog (100) including list prices on "Genuine Detroit" automatic controls and equipment for lubrication and all types of heating, refrigeration and air conditioning. The various units are described and illustrated in detail.

No. 2955. CONVECTORS: Trane Co., La Crosse, Wis. 12 p. bulletin (S328) on convectors for apartment houses and housing projects, describing the equipment and illustrating many buildings in which it is used.

No. 2956. COPPER PLATING: E. I. du Pont de Nemours & Co., R. & H. Chemicals Dept., Wilmington, Del. 8 p. issue of "Artic Service News" (Vol. 4, No. 3) devoted to an article on copper plating in refrigerating compressors, by E. W. McGovern. This paper, which was presented by the author at the spring meeting of the A. S. R. E., is an extensive technical discussion of the subject.

Avoid the High Cost of DIRTY, WET, OILY STEAM



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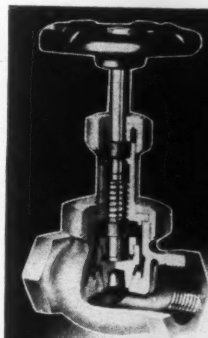

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- For a small (1 to 5 H. P.) inexpensive, unjacketed boiler, we recommend the MKAYO. *Details of this—the KANE—or both, cheerfully furnished.*

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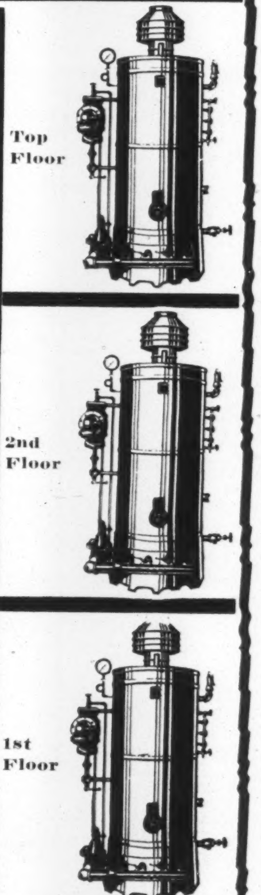

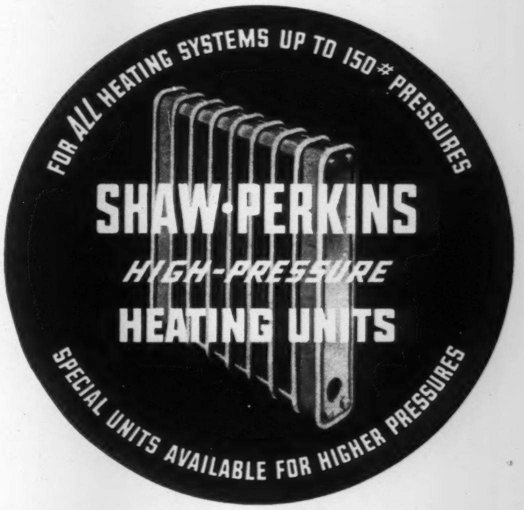
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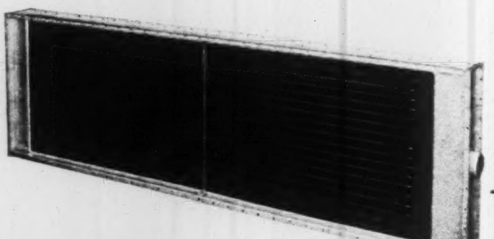

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No. 2957. CORROSION PROTECTION: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 4 p. descriptive data sheet (27-450) on "Rectox" rectifiers designed to counteract galvanic action and electrolysis by maintaining a small direct current from ground to structure, a technique known as "cathodic protection." Principal application is protecting underground pipe lines.

No. 2958. DRIVES AND BELTING: Teuscher Pulley & Belting Co., 801 N. Second St., St. Louis, Mo. 1938 catalog covering wide variety of products including belting, pulleys, drive bases, stock v-belt drives, sheaves, etc.

No. 2959. EXTENDED SURFACE COILS: Trane Co., La Crosse, Wis. 20 p. bulletin (S330) on extended surface coils, describing construction, flexibility in application, various types of coils for specific services, and illustrating various installations.

No. 2960. FANS: L. J. Wing Mfg. Co., 14th St. and 7th Ave., New York, N. Y. Bulletin (F-7) on "Wing-Scruplex" propeller type fan for delivering air efficiently against pressure. Available in rating capacities from 860 to 78,000 cfm. Fans for ordinary ventilation applications, acid resisting fans, dye-house fans, motor drives and pulley drives, protective shutters and penthouses are included. A table for easy selection of fans to deliver air through ducts of various sizes and lengths is presented.

No. 2961. GAS BOILERS: Surface Combustion Corp., 2375 Dorr St., Toledo, Ohio. 24 p. specifications catalog covering line of "Janitrol" gas boilers for use with steam, vapor and hot water heating systems. The steam boilers have ratings of 195 to 1545 sq ft and the water boiler ratings range from 314 to 2554 sq ft. Much of the catalog is devoted to use of boilers for supplying domestic hot water and many tables, formulas and diagrams are given.

No. 2962. GAS BURNERS: Lee B. Mettler Co., 406 S. Main St., Los Angeles, Calif. 4 p. bulletin describing "Fan-Air" motorized fan gas burner assembly, describing features and uses.

No. 2963. HEATING UNITS: Young Radiator Co., 709 Mead St., Racine, Wis. 4 p. catalog (6538) on "Type F. C." heating units for particular application in corridors, halls, auditoriums and commercial buildings. A description of features is given and capacity tables and a sound level table are presented.

No. 2964. INSULATION: Crown Cork & Seal Co., Inc., Insulation Div., Baltimore, Md. 4 p. reprint entitled "Cold Storage Lockers and Locker Plants," by P. Edwin Thomas, giving a brief outline of this important development in the refrigeration field with particular attention to insulation.

No. 2965. PIPE TOOLS: Beaver Pipe Tools, Inc., Keeney Ave., Warren, Ohio. 4 p. condensed catalog (Form 438) illustrating and describing this manufacturer's line of pipe tools.

No. 2966. RECORDING GAGES: Foxboro Co., 106 Neponset Ave., Foxboro, Mass. 8 p. bulletin (208) with information and illustrations on recording gages and accessories, discussing importance of spring construction with particular reference to the all-welded steel helical movement, the diaphragm spring movement, the spiral spring and the bourdon spring movement.

No. 2967. REGISTERS AND INTAKES: Auer Register Co., 3608 Payne Ave., Cleveland, Ohio. New catalog (38A) describing and illustrating complete line of registers and intakes for air conditioning purposes.

No. 2968. RELAYS: Advance Electric Co., 1260 W. Second St., Los Angeles, Calif. 10 p. catalog on circuit control relays, time delay relays, transmitter relays, electronic relays, overload relays, and other types.

No. 2969. ROOM VENTILATORS: Carrier Corp., Syracuse, N. Y. 4 p. bulletin describing new room ventilator for homes, offices and apartments, which circulates cleaned outside air, recirculates filtered room air, and shuts out noise, dirt, dust and pollen.

No. 2970. SOLENOID OPERATED VALVES: Automatic Switch Co., 154 Grand St., New York, N. Y. 4 p. bulletin illustrating and describing "Asco" solenoid operated valves for automatic remote control of air, steam, liquids and gas.

UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free.
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THE RIDGE
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The Guaranteed RIDGID Housing keeps this Wrench on the job . . . doing better work.

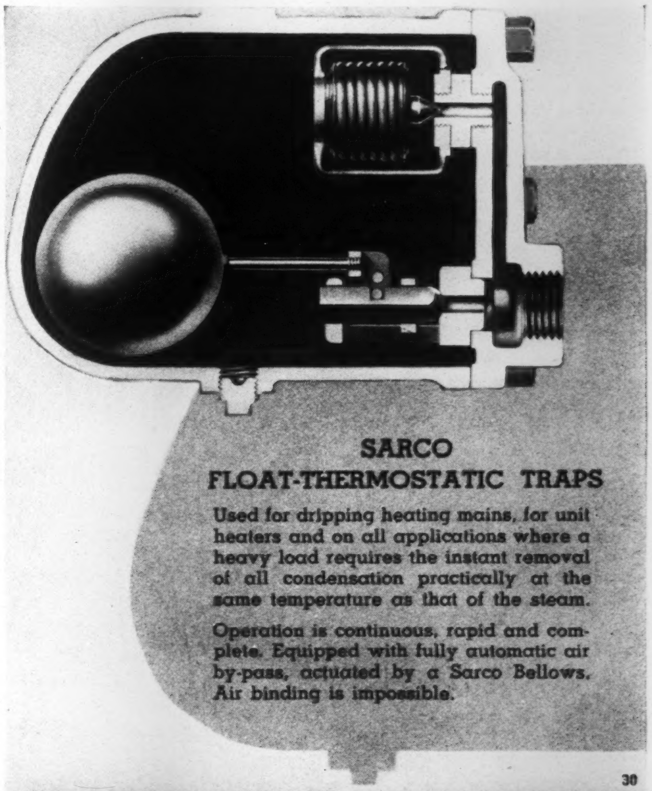
Millions of RIDGID wrenches in use under that housing guarantee — and the users will tell you they *stay on the job,* avoiding nuisance of repairs, saving you money. You enjoy using the safe all-alloy RIDGID with replaceable chrome molybdenum jaws, adjusting nut that never binds even in 60″ size, powerful I-beam comfort-grip handle.

It's a tool that inspires workmanlike pride and care. For economy and efficiency, buy RIDGIDs — at your Supply House.

THE RIDGE TOOL CO., ELYRIA, O.

RIDGID PIPE TOOLS

DID YOU MAKE A NOTE OF THE IMPORTANT ANNOUNCEMENT ON PAGE 24?



SARCO FLOAT-THERMOSTATIC TRAPS

Used for dripping heating mains, for unit heaters and on all applications where a heavy load requires the instant removal of all condensation practically at the same temperature as that of the steam.

Operation is continuous, rapid and complete. Equipped with fully automatic air by-pass, actuated by a Sarco Bellows. Air binding is impossible.

30

COMPLETE SYSTEMS FOR HEATING AND INDUSTRY

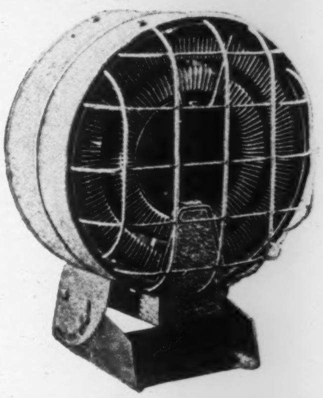
SARCO

REPRESENTATIVES IN ALL PRINCIPAL CITIES

THERMOSTATIC, FLOAT AND BUCKET TRAPS, REGULATORS AND HEATING SPECIALTIES

SARCO COMPANY, Inc., 183 MADISON AVENUE, NEW YORK, N. Y.
SARCO CANADA LIMITED, FEDERAL BLDG., TORONTO, ONT.

Use flexible ELECTRIC HEAT *for variable Fall temperatures*



Chromalox electric heating units are "flexible" because they can be snapped on for instant operation at any time, day or night. They can be installed anywhere—there are no "hard-to-reach" spots for electric heat. Their installation is quick and costs little. They can be set up to deliver a column of heated air at any angle, placed just where it will do the most good. They readily meet every heating need, process applications included.

●

Engineers and industrial executives find the Chromalox Catalog and Handbook of Electric Heat of constant value for reference. Your request brings a copy.

CHROMALOX
ELECTRIC UNIT HEATERS

are built in types for shop, office, salesroom, home, etc. in capacities from 1.5 to 20 Kw. They use one type of the famous Chromalox electric heating element, known for dependability and economy in thousands of industrial applications. Full details in the 64-page Chromalox catalog.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh, Pa.

For Your Convenience

Heating, Piping and Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [10-38]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

1539	1540	1541	1542	1543	1544	1545
1546	1547	1548	1549	1550	1551	1552
1553	1554	1555	1556	1557	1558	1559
1560	1561					
2948	2949	2950	2951	2952	2953	2954
2955	2956	2957	2958	2959	2960	2961
2962	2963	2964	2965	2966	2967	2968
2969	2970	2971	2972	2973	2974	2975
2976	2977	2978	2979			

Name...Title...............

Company ....

Address ....

City...State...............

No. 2971. TELEMETERING: Bristol Co., Platts Bridge, Waterbury, Conn. 24 p. bulletin (515) on "Metameter" system of telemetering with detailed information on telemetering instrument readings. Various models available for remote measurement and automatic control of pressure, vacuum, liquid level, temperature, flow, voltage, current, load, and totalized power load are illustrated, and the booklet is intended to be a comprehensive reference for the files of supervising engineers.

No. 2972. TEMPERATURE GAGES: Weston Electrical Instrument Corp., 619 Frelinghuysen Ave., Newark, N. J. 12 p. booklet on industrial temperature gages with complete information about new all metal thermometers available in both general purpose and heavy duty types. Specifications and illustrations of the different items are included.

No. 2973. UNIT FANS: Carrier Corp., Syracuse, N. Y. 4 p. bulletin on new line of unit fans describing one fan, two fan, and three fan units available in six sizes for vertical or horizontal air discharge. These units provide ventilation and positive air circulation and may be used with controls and heating coils as recirculators and boosters for central air conditioning systems.

No. 2974. UNIT HEATERS: Young Radiator Co., 709 Mead St., Racine, Wis. 16 p. catalog (2738) on "Types SH and TH" unit heaters with complete description, illustrations of features, extensive capacity tables and application data.

No. 2975. VALVES: Monat Valve & Forge Co., Inc., 900 Bessemer Bldg., Pittsburgh, Pa. Leaflet describing packless globe valves and their features.

No. 2976. VARIABLE SPEED TRANSMISSION: Ideal Commutator Dresser Co., 1096 Park Ave., Sycamore, Ill. Leaflet describing "Select-O-Speed" variable speed transmission for stokers and other equipment, and its features and uses.

No. 2977. VIBRATION INSULATORS: B. F. Goodrich Co., 548 Main St., Akron, Ohio. 8 p. illustrated catalog covering standard line of "Vibro-Insulator" rubber to metal type mountings. In addition to describing the six types and listing dimensions, the catalog serves as a practical guide on the factors involved in selecting and installing such mountings.

No. 2978. WELDER'S TROUBLE-SHOOTER: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 8 p. booklet (B.2150-A) listing common troubles met by welders together with the cause and cure for each. Some of the troubles mentioned are distortion, welding stresses, cracked welds, undercut, porous welds, brittle joints and corrosion.

No. 2979. WELDING: Thomson-Gibb Electric Welding Co., Lynn, Mass. 4 p. issue of house organ "Flashes" with information on how to weld aluminum, copper, stainless steel, nickel and Monel metal.

INDEPENDENT "Fabrikated" REG. U.S. PAT. OFF.

adjustable
DIRECTED AIR FLOW
REGISTERS and GRILLES

Each grille bar can be set individually to direct air flows right or left or up or down, either at the time of installing, or after the system is in operation.

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3747 E. 93rd ST., CLEVELAND, OHIO

CHECK YOUR HEATING INSTALLATIONS WITH THE "ALNOR" VELOMETER

This all-purpose air velocity meter indicates air velocities directly and instantaneously on the scale in f.p.m. without the necessity of timing or mathematical calculations. Standard range 0-300, 0-3000 f.p.m. Other ranges available up to 18,000 f.p.m.

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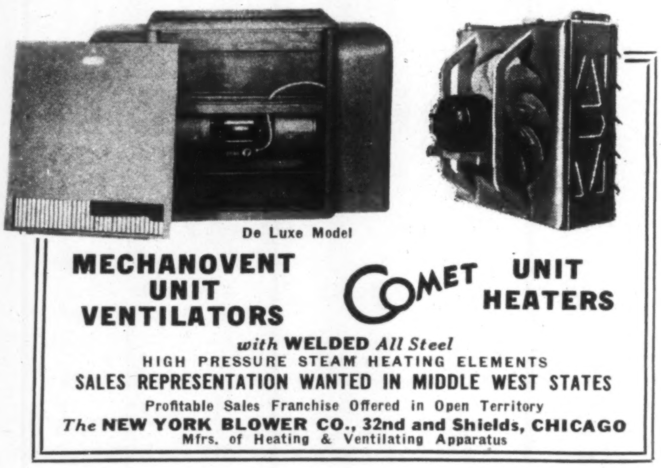
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MECHANOVENT UNIT VENTILATORS

COMET UNIT HEATERS

with WELDED All Steel
HIGH PRESSURE STEAM HEATING ELEMENTS
SALES REPRESENTATION WANTED IN MIDDLE WEST STATES
Profitable Sales Franchise Offered in Open Territory
The NEW YORK BLOWER CO., 32nd and Shields, CHICAGO
Mfrs. of Heating & Ventilating Apparatus

ILLINOIS
SELECTIVE PRESSURE
CONTROL SYSTEMS

A NEW and EXCLUSIVE development in controlled heating that offers a broader and more attractive sales opportunity. EACH SYSTEM is individually engineered to meet exact requirements. Designed for either manual or thermostatic control.

Control of steam generation to vary the continuous supply of low temperature steam with ILLINOIS SELECTIVE PRESSURE SYSTEMS opens a new and lucrative field for the sale of control systems in apartments, schools, churches, commercial and public buildings . . . control that heretofore has been adaptable to only the larger heating installations.

In large installations where process steam or zoning requirements do not permit the variable control of combustion, and in housing projects or on Central Station service, ILLINOIS FLOW CONTROL VALVES are used. They are of the full floating type, giving complete regulation of steam flow. Furnished for manual, pneumatic or electric operation.

MODERNIZATION

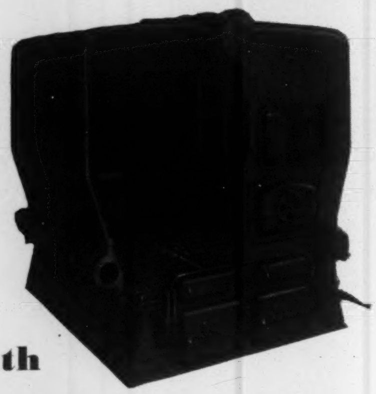
ILLINOIS SELECTIVE PRESSURE SYSTEMS are the perfect answer to the Modernization problem. Existing vapor or vacuum installations of ANY size may be changed over at low cost to give the convenience and economy of perfect control—a small investment that will return big dividends in fuel saving, heating comfort and owner satisfaction.

Write for bulletins 16 and 517, which describe and illustrate this outstanding development in modern heating

HEAT CONDITIONING FOR COMFORT

ILLINOIS ENGINEERING COMPANY
2045 SOUTH RACINE AVENUE, CHICAGO

You can slip one of the twin sections through most any decent size door, and even some what are a bit skimpy.



A Steel Clad Boiler Truth That Flatly Contradicts Itself

Now and again there's a lot of carelessness going on about handling the truth.

Here lately, and before that even, the fellers what has only steel boilers ter make a living with, have been making a big to-do about as how steel transmits the heat so alfired fast. And as how cast iron ain't so spritely.

To them, that's reason enough to buy their steel boiler.

So fur as the truth about comparative heat transference is concerned, they told it.

But even so, you edicated engineers know that either one transfers heat faster than the water can absorb it, and there ain't nuthing anyone can do about it.

However, if you like the idee of quicker transference, well then we make a welded steel boiler to fit it.

On t'other hand, if you lean towards cast iron, we make a twin section one that you can lean your whole weight on.

A lot of smart engineering fellers is using it on replacement jobs, because they don't have to rip a big hole in the buildin to get it in.

However, it's not fur us to say to you, which Burnham to decide on. We're leaving that to your hoss sense, which somebody told us you had a good supply of.

Hank Hindle

Burnham Boiler Corporation

Distributed Through Wholesalers

IRVINGTON, N. Y. ZANESVILLE, OHIO

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Export Department: 50 Church St., N. Y. City

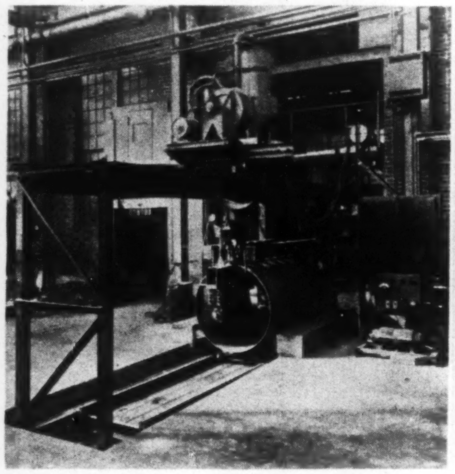
Burnham Boiler

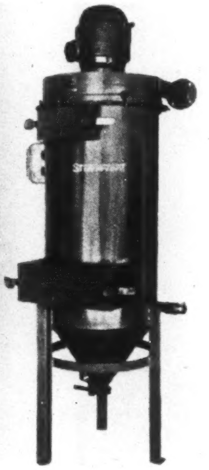
Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 122. Add the new products and companies listed here to your Directory Section which you received in your January, 1938, HEATING, PIPING AND AIR CONDITIONING and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Unfused Melt Recovery Unit

No. 1562—A system for recovering those portions of the granular "melt" which remain unfused in modern heavy automatic welding has recently been developed. This unfused melt, which is of considerable value, is recovered by a pick-up tool and transferred by vacuum through a wire reinforced rubber hose to a collector from which it can be removed for re-use.



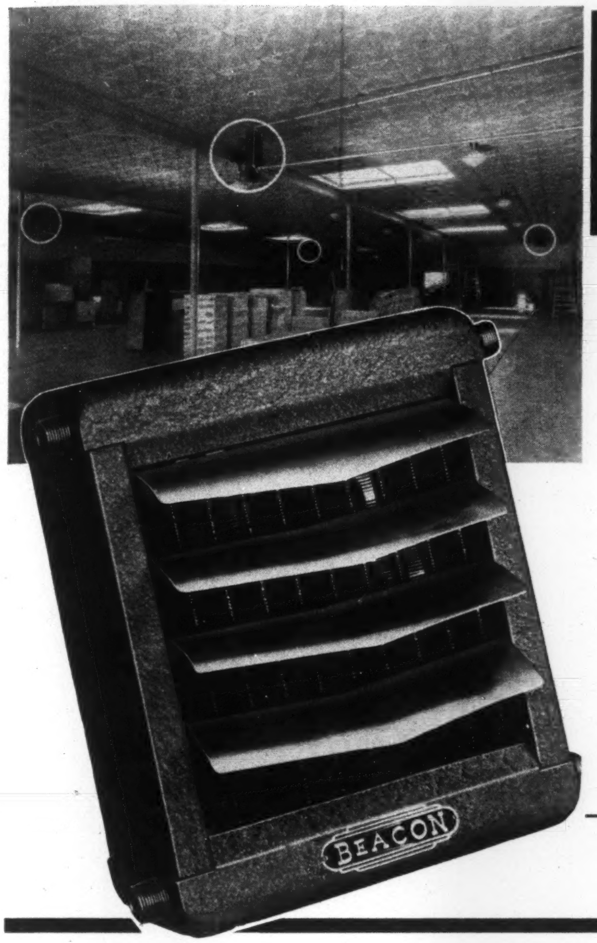


Two types of these melt recovery units are manufactured. Shown here is the stationary recovery unit which is designed to be installed on a traveling crane to be moved over the work, or on a platform under which the work is moved. The stationary unit is equipped with a cone bottom collector so that the recovered melt returns to the feeding device by gravity. The pick-up tool is attached to the welder carriage so that melt recovery is entirely automatic. This unit may also be furnished with a flat bottom collector and may serve as a semi-portable unit to be used on heavy work at different points in the plant.

A portable unit which is for use in intermittent service shops where welding is done in many locations is also made. This type of unit is mounted on casters for easy handling and is equipped with a flat bottom collector. In the portable model, the pick-up tool is manually operated and the reclaimed melt is transferred by hand from the collector to the feeder hopper of the welding apparatus.—B. F. Sturtevant Co., Damon St., Hyde Park, Boston, Mass.

Electrically Operated Valve

No. 1563*—A departure from conventional design of solenoid valves is found in a new electrically operated valve, whose design was developed to insure tight closure against water or fluid pressure up to 150 lb, and to assure positive operation for those services where dependability is essential. In accomplishing this, the weight of the solenoid armature is not depended upon to hold the valve closed. Instead, it is tightly seated by a spring loaded leverage system. The long lever connected to the armature of the solenoid gives the solenoid sufficient mechanical advantage for positive opening of the valve, the maker states.



BEACON UNIT HEATERS

The Line You've Been Looking For

SMART MODERN STYLING—QUIET OPERATION
STURDY CONSTRUCTION—EFFICIENT PERFORMANCE

Consider these features of Beacon Construction:

1. Vertical seamless copper tubes brazed into rugged seamless copper headers, eliminate *all bolts, gaskets and joints.*
2. Heavy Gauge Aluminum or Copper fins, scientifically proportioned and arranged, present the most effective heating surface.
3. Fins have wide contact collars insuring permanent, tight fit around tubes and maximum heat transfer.
4. Fins are rigid, without crimping. Their smooth surfaces prevent accumulation of dust and lint.
5. Inlet end of the tubes are orificed, eliminating lazy sections and reducing temperature strains to a minimum.

Male steam connections extend beyond both right and left sides of the cabinet. Return connections are also piped from either side. Capacities range from 112 to 1,325 feet of radiation.

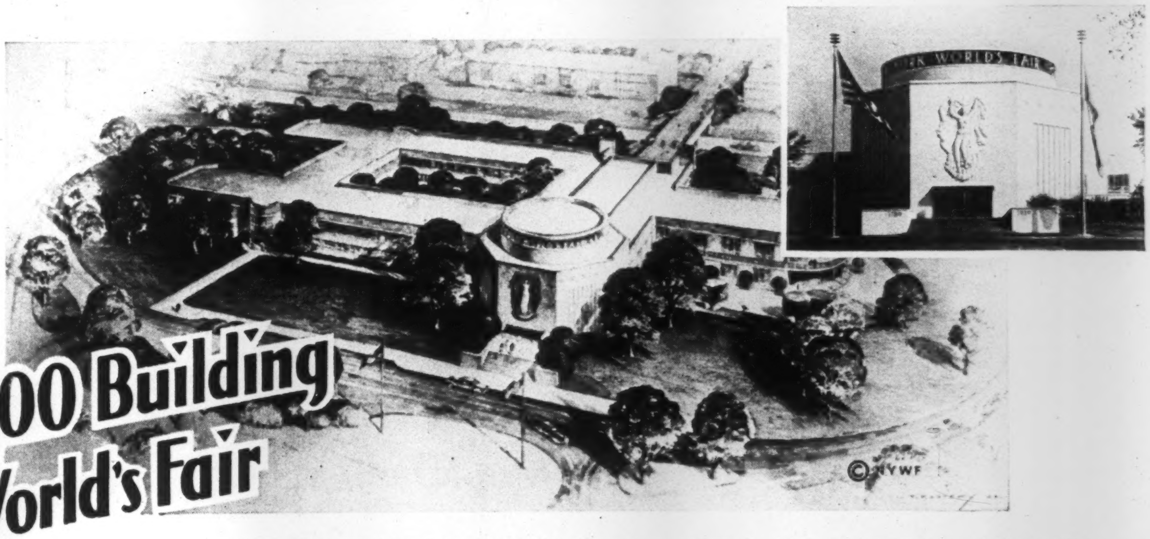
Over twenty-five years experience in the manufacturing of heat transfer equipment is your assurance that Beacon Heaters will prove desirable, dependable and profitable units for every type of installation.

Send for more complete DETAILS—Today

A few desirable territories still available for Recognized Distributors.

Illustration is of Beacon installation in new Chain Super-Market.

BEACON-MORRIS CORPORATION
702 Beacon Street **Boston, Massachusetts**



$900,000 Building at N.Y. World's Fair uses FRICK Air Conditioning

TRADE MARK

Keeping 700 executives and staff people comfortable in 112 separate offices, as well as when 500 of them have lunch in the cafeteria, is a job for any air conditioning system. Especially when the building, administrative center for the 1939 World's Fair, spreads over 1⅓ acres, and is divided into 5 zones. Each zone has its Frick Refrigerating System for air conditioning.

Let us quote on that special air conditioning, refrigerating or ice-making job of yours. Write

FRICK COMPANY
Waynesboro, Penna.

FULTON
Sylphon
TRADE MARK
FOR
TEMPERATURE
CONTROL

• of Duct Heating and Air Conditioning

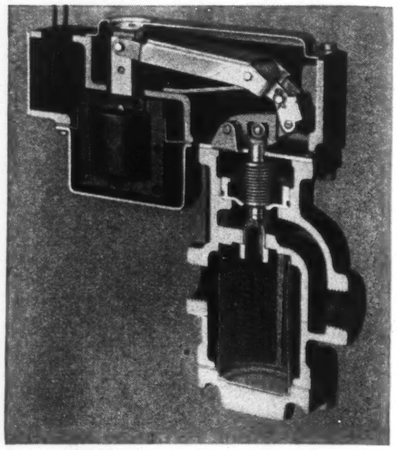
Fulton Sylphon offers architects and engineers a line of controls ideally suited to the regulation of duct temperatures in air conditioning and indirect heating and ventilating systems where heating is by steam coils in the ducts, and cooling is by circulated cold water or calcium chloride brine.

Principal reasons for Sylphon preference are: Modulating action of Sylphon controls for maintenance of desired temperatures within extremely close limits; self-contained, self-powered, compact design, easy to install, and requiring no compressed air, no wiring, motors, levers, chains or other auxiliary equipment; patented star-shaped bulbs and coil type bulbs providing unusual sensitivity; dependability of rugged all metal construction from the finest materials available; products of specialists in temperature control for over thirty years.

New Sylphon Bulletins describe the present complete line of Sylphon controls for this and other temperature control services. Ask for your copies.

● Individual Room Temperature Control — Bulletins VE 80 and VE 70 . . . Zone Control—Bulletin VE 70 . . . Space Heat Control in Large Industrial Areas—Bulletins VE 50 and VE 70 . . . Duct Type Heating and Air Conditioning Controls—Bulletin VE 50 . . . Service Hot Water Supply Control—Bulletins VE 20 and VE 40 . . . Drinking Water Temperature Control—Bulletin VE 20.

THE FULTON SYLPHON CO.
KNOXVILLE, TENNESSEE
Representatives in All Principal Cities in U. S. A. and in Montreal, Canada and London, England

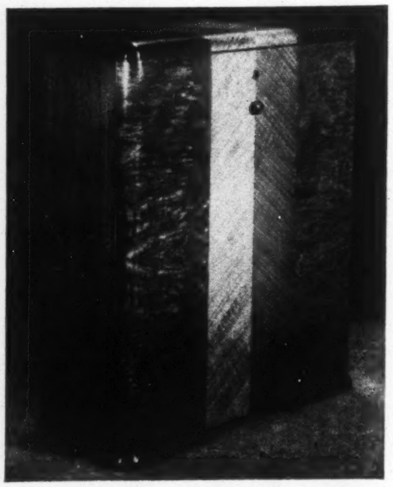


The valve and seat are stainless steel of file hardness and packing is eliminated by the use of a "Sylphon" bellows. A feature is the slot-and-roller construction which removes angular stress from the valve stem and assures straight thrust of the cone when seating. The valve is protected by a large built-in strainer. The button at the end of the lever provides for manual operation or testing.

The valve will handle any fluid not corrosive to its working parts at any inlet pressure up to 150 lb. Discharge capacity ranges from 1100 to 3200 lb (of water) per hr depending, of course, on differential between inlet and discharge pressures. Standard electrical rating is 115 volts, 60 cycle, but coils for other voltages and frequencies are available.—McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill.

Portable Electrostatic Air Cleaner

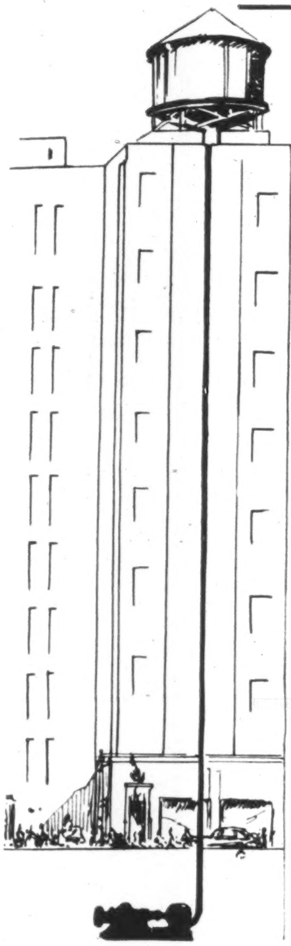
No. 1564*—A new self-contained, portable, electrostatic air cleaner, or "Precipitron" room unit, has been designed especially for the relief of hay fever and pollen asthma sufferers, but is also applicable for general air cleaning in an average sized room. It operates from the standard 115 volt outlet, drawing approximately 80 watts, and circulates 240 cfm of air. It may be adjusted to draw in air from the outside, or recirculate room air.



It bears the approval of the Underwriters' Laboratories and the Council on Physical Therapy of the American Medical Association. It is quiet in operation, having a newly patented centrifugal blower, and is entirely free from radio interference, according to the maker. The unit depends for its operation upon the cleaning action on gases of a corona discharge. Dirt particles and foreign matter in the air are charged in an ionizing section and then precipitated on the charged plates of the dirt collector cell. Cleaning of the collector cell is accomplished by washing about once every six weeks.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

New Spray Nozzle for Humidifying

No. 1565**—The illustration shows a pneumatic atomizing nozzle just placed on the market which is available with externally mixed round spray, internally mixed round spray, and internally mixed flat spray. Compressed air and liquid pipe con-



Keeping the Tank FULL on the roof requires a DEPENDABLE PUMP in the basement

● There is probably nothing more exasperating than to turn on the faucet in an upper floor of a building and have only a trickle of water come forth.

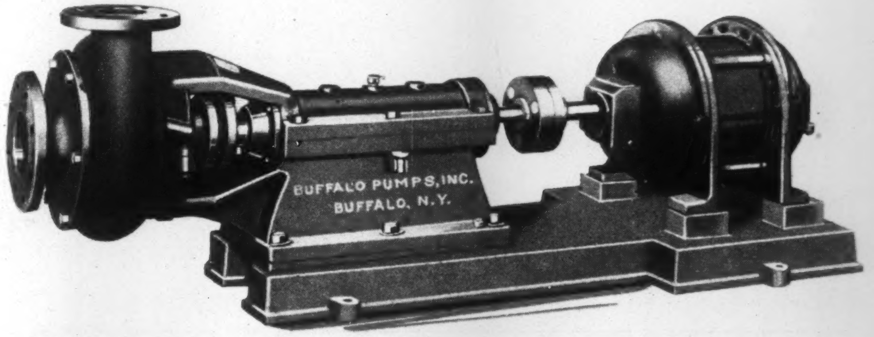
You can avoid this sad experience in your buildings by installing Buffalo High Head Double Suction Pumps. Hundreds of these pumps are on the job 24 hours a day in office buildings and factories. Their records of trouble-free performance year after year tell the story of Buffalo Pump quality—dependability—economy.

Write for Bulletin 967-A.

BUFFALO PUMPS, INC.

171 MORTIMER ST. BUFFALO, N. Y.

Branch Engineering Offices in Principal Cities
In Canada: Canada Pumps, Ltd., Kitchener, Ont.



"The last word in practicality..."

NESBITTS have tried to think of all the questions you could possibly ask about SERIES H Heating Surface, and to answer them all—and many more—in a new Catalog (Publication 232) on this durable, light-weight element of corrosion-resistant copper and copper alloy. This Surface is highly efficient for all applications involving steam-to-air heat transfer. Designed for steam pressures up to 200 pounds gauge. 784 sizes and capacities. Get this catalog and get the facts. John J. Nesbitt, Inc., Holmesburg, Philadelphia, Pa.

SOLD BY LEADING MANUFACTURERS OF FAN-SYSTEM APPARATUS

For low-pressure, valve-controlled installations requiring extreme controllability, use Nesbitt Heating Surface with Steam-distributing Tubes—Publication 229-1.

NESBITT

SERIES H HEATING SURFACE

Send for a Catalog

Send this coupon for a copy of Publication 232, containing complete description and engineering data on Nesbitt Series H Heating Surface. Sign your name and address or mail the coupon attached to your letterhead.

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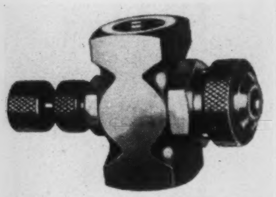
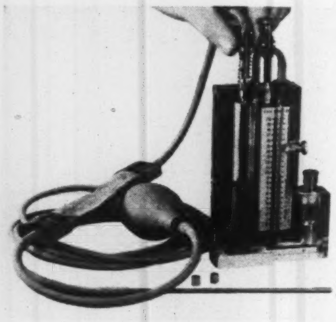


nections are both ¼ in. female. Standard stock construction is brass; other metals can be specified.

This nozzle is used for humidifying or wherever complete atomization is required.—Spraying Systems Co., 4922 W. Grand Ave., Chicago, Ill.

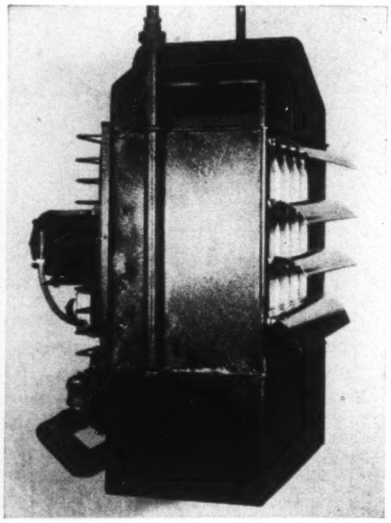
Carbon Dioxide Indicator



No. 1566—Of interest to those engaged in the design, installation, and servicing of heating equipment is the announcement of a new carbon dioxide indicator containing unique features. The instrument is of a new transparent composition which is strong and durable and absolutely unaffected by the caustic solutions used in the indicator, according to the maker. The small size of the instrument is indicated in the illustration.

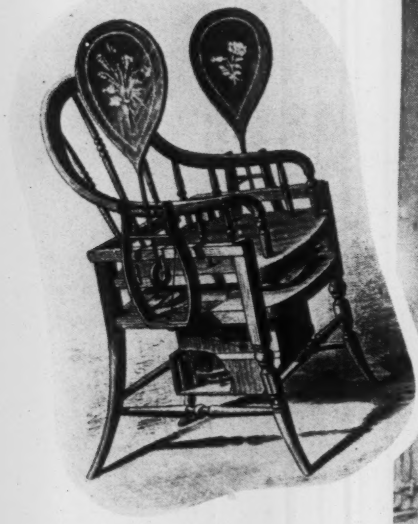
A feature is the highly polished, chromium plated, graduated adjustable scale, making possible accurate readings because errors of parallax are eliminated. Readings are obtained by lining up the meniscus of the vertical mercury column with the graduations on the adjustable scale and the reflection of the meniscus in that polished scale.—Julien P. Friez and Sons Inc., 4 N. Central Ave., Baltimore, Md.

Gas Fired Unit Heater



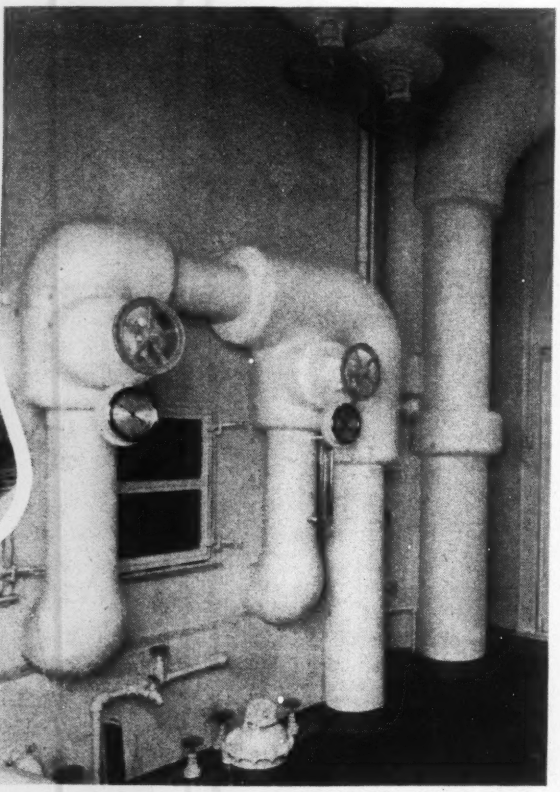
No. 1567**—A new gas fired unit heater, operating without steam or water and completely self-contained, is suitable for many types of commercial and industrial buildings such as stores, garages, schools, churches and manufacturing plants. The unit is suspended from the ceiling, and employs natural or manufactured gas for fuel. In addition to heating, it may be adapted for other purposes such as ventilating, cooling and drying. It is available in five sizes ranging from 85,000 to 200,000 Btu per hr.

Operation and construction is simple. The gas fires into a combustion chamber, the products of combustion being passed upward through a bank of tubes and out at the rear of the housing. Air is passed around these tubes by means of a motor driven fan on the back of the unit. The assembly includes a safety pilot which turns off the gas if the pilot goes out or burns too low to insure ignition.—Automatic Gas Steam Radiator Co., 446 Brushton Ave., Pittsburgh, Pa.



AIR-CONDITIONED CHAIR

This automatic chair and fan device was invented 60 years ago. The weight of the body lowered the seat frame which operated on anti-friction rollers. The chair required 25 minutes to descend, completing 1257 strokes of the fan. In this and other unique ways, man has attempted thru the centuries to solve the problem of temperature control.



Mundet Cork Insulation protects this air-conditioning unit. It is available in special thicknesses for air-conditioning requirements.

PROBLEMS

of temperature control are greatly lessened through the use of Mundet Cork Insulation. In the form of corkboard or moulded pipe covering, Mundet Cork Insulation serves as a natural barrier to heat flow. It doesn't wear out, warp or settle.

To give these benefits, Mundet Cork Insulation must be properly installed. We maintain a complete installation service for this purpose. For heat loss charts and full information covering cork insulation and machinery vibration isolation, write to our Brooklyn office.

MUNDET CORK CORPORATION
INSULATION DIVISION 65 South 11th Street, Brooklyn, N. Y.
Offices in Principal Cities

POWER CHANGES AFFECT HEATING, VENTILATING AND AIR CONDITIONING PROGRESS

• *Your future is at stake*

Your future depends on how well you understand and apply the many new methods and devices for reducing the cost of power and heat. See them now, for they are ready. See them at the coming National Power Show—the 13th National Exposition of Power and Mechanical Engineering at the Exposition Capitol of the World—Grand Central Palace, New York, in December. More than 270 progressive manufacturers will exhibit the newest products of their ingenuity and resources devoted to the improvement of power and heat generation, transmission and use. See these exhibits—tomorrow's engineering on display today. Your own future is at stake.

More than 40,000 engineers and executives are expected.

Come and bring your associates.

DEC. 5-10 1938
13TH NATIONAL EXPO
OF POWE
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13TH NATIONAL EXPOSITION
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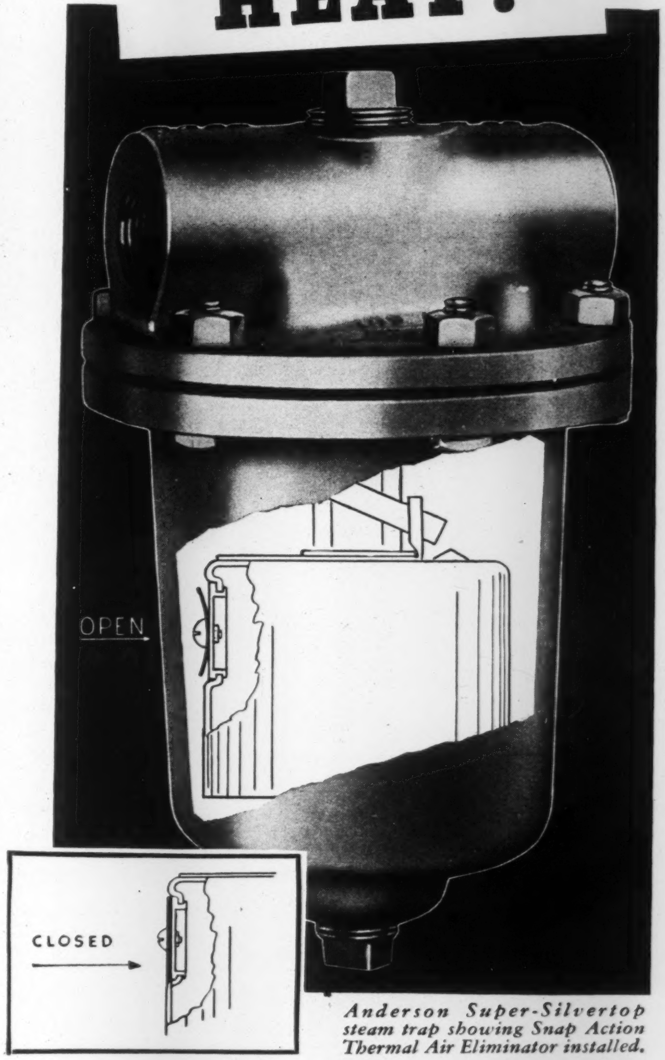
INSTANT HEAT!



Anderson Super-Silvertop steam trap showing Snap Action Thermal Air Eliminator installed.

Fast heat from steam using equipment depends on instant removal of entrained air. Anderson Super-Silvertop traps when equipped with Snap Action Air Eliminators, give instant air removal. This thermal element incorporating a Spencer Disc, acts positively and between definite limits, thus preventing steam losses. When system is cold, trap is wide open to discharge air, the Spencer Disc curving away from three underlying holes in the bucket (see illustration above). When steam reaches the trap, the disc immediately snaps shut, preventing any steam loss. The trap then operates normally.

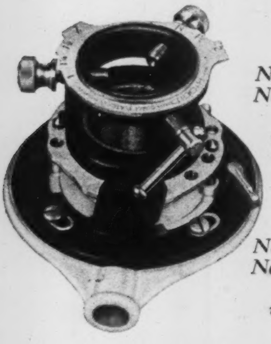
Get faster heat and higher temperatures without increasing steam pressures and without steam losses—investigate the Anderson Super-Silvertop with Snap Action Thermal Air Eliminator. Write today for complete details.

THE V. D. ANDERSON CO.
1949 West 96th Street • • Cleveland, Ohio

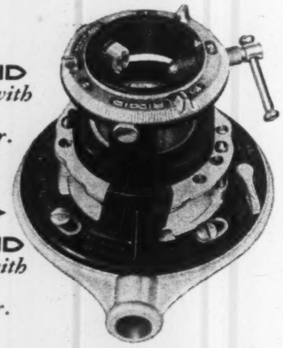
New
4 IN 1
GAUGE PLATE
1
1¼
1½
2
Easier speedier pipe threading...

Rugged new **RIDGID** No. 65-R All-Steel-Malleable-Alloy Die Stock, ***with drop-forged hardened tool-steel cam plate, Threads 4 sizes of pipe with 1 set of chaser dies.*** Your choice of 2 new mistake-proof workholders.

New strength and durability throughout. Quick automatic setting to size saves time and loss of chasers. Two speedy workholders, both practically automatic—no bushings. A modern super-efficient tool you'll take workmanlike pride in. Buy it—for quicker easier better threading at lower cost. Ask your Supply House.



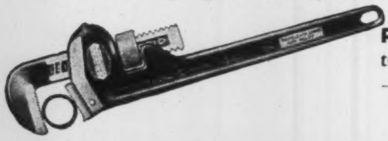
New **RIDGID** *No. 65-RP with plate type workholder.* ←



→ *New* **RIDGID** *No. 65-RC with cam type workholder.*

THE RIDGE TOOL CO., ELYRIA, O.

No more pipe wrench housing repairs



RIDGID housing guaranteed not to break or warp —or we replace it Free.

RIDGID PIPE TOOLS

Electric Welding Process for Steel Plate

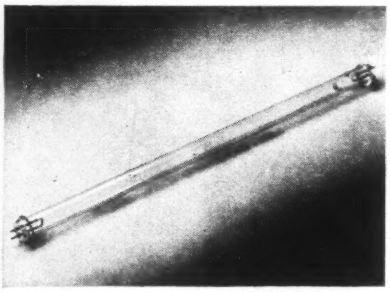
No. 1568—The "Unionmelt" welding process, a new electric welding method which has been adopted in a number of industrial plants principally for welding steel plate, was demonstrated at the National Metal Exposition in Detroit last month. This process provides a speedy and automatic method of making butt welds, fillet welds and plug welds of exceptional quality and high strength in any commercially used thickness of low carbon and medium carbon steels, high strength steels, and stainless and other alloy steels, according to the manufacturer. The equipment can be used anywhere, the only requirement being a suitable source of 110 volt single phase alternating or direct current.

Welds for certain applications can be made as much as 20 times faster with the process than with other methods, it is stated. For example, high quality butt welds can be completed in one pass at the rate of 10 to 12 in. per minute in 1 in. steel plate, and at the rate of 5 to 6 in. per minute in 2 in. steel plate.

The method is an electric process using the heat generated by the passage of an electric current from an electrode to the work being welded. The end of the electrode is constantly covered by a highly resistant, conductive medium applied as a special granulated material known as "Unionmelt" welding composition. This granulated material is laid down along the seam to be welded, and the entire welding action takes place beneath it, without an open visible arc, and without sparks, spatter, smoke, or flash.—The Linde Air Products Co., 30 E. 42nd St., New York, N. Y.

Lamp for Small Unit Air Sterilizers

No. 1569—A new ultra-violet "Sterilamp" is primarily intended for use in special applications, such as cabinet sterilizers, small unit air sterilizers, etc., and for such other special purposes where either the need for or desirability of 115 volt operation is sufficient to offset the advantages of higher efficiency and flexibility inherent in the cold cathode "Sterilamp" line. It is not now recommended for use in walk-in refrigerators or meat display cases or in the general field of food preservation.



This new lamp, the development of which is now complete, is a 10 in. hot cathode lamp, ½ in. diameter and designed for operation on 115 volt a-c circuit with a current control unit similar to that used with fluorescent mazda lamps.—Westinghouse Electric & Mfg. Co., Bloomfield, N. J.

Pocket Stack Temperature Thermometer

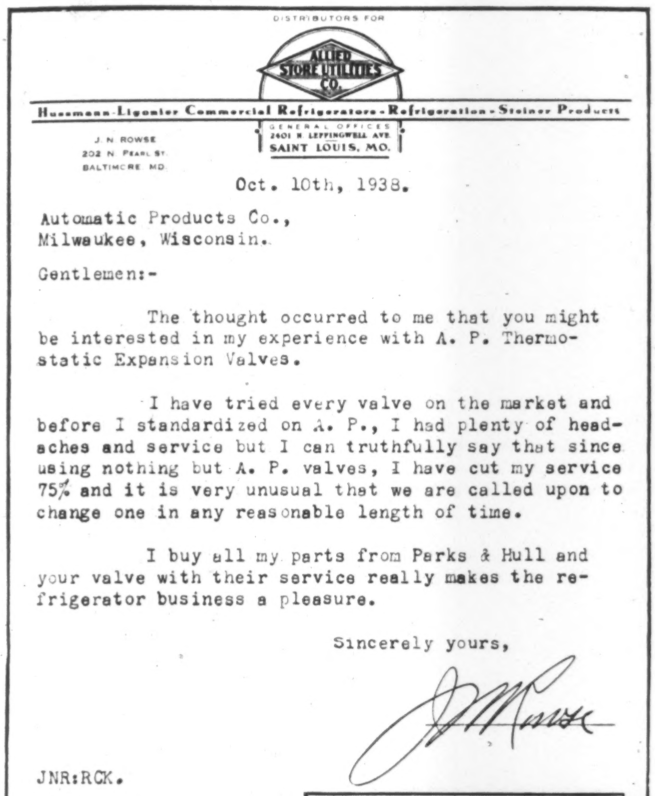
No. 1570—A new pocket stack temperature thermometer incorporates a novel reversible combined "case-handle".

The material used in these thermometers is of special high temperature glass specially annealed and treated for the purpose. The standard range is from 30 to 900 F in 10 deg divisions.

The thermometers are lens-front, providing exceptionally good precision and ease of reading, according to the maker. Length is 7½ in.—Julien P. Friez and Sons, Inc., 4 N. Central Ave., Baltimore, Md.

"USING NOTHING BUT A-P VALVES . .

Cut My Service 75%!"



DISTRIBUTORS FOR

ALLIED STORE UTILITIES CO.

Hussmann-Ligonier Commercial Refrigerators - Refrigeration - Steiner Products

J. N. ROWSE
202 N. PEARL ST.
BALTIMORE, MD.

GENERAL OFFICES
2401 N. LEFFINGWELL AVE.
SAINT LOUIS, MO.

Oct. 10th, 1938.

Automatic Products Co.,
Milwaukee, Wisconsin.

Gentlemen:-

The thought occurred to me that you might be interested in my experience with A. P. Thermostatic Expansion Valves.

I have tried every valve on the market and before I standardized on A. P., I had plenty of headaches and service but I can truthfully say that since using nothing but A. P. valves, I have cut my service 75% and it is very unusual that we are called upon to change one in any reasonable length of time.

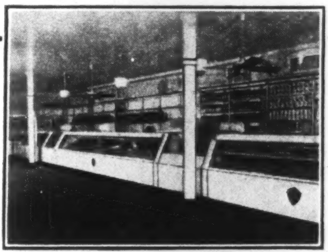
I buy all my parts from Parks & Hull and your valve with their service really makes the refrigerator business a pleasure.

Sincerely yours,

J N Rowse

JNR:RCK.

A SUBSIDIARY OF THE HUSSMANN-LIGONIER COMPANY

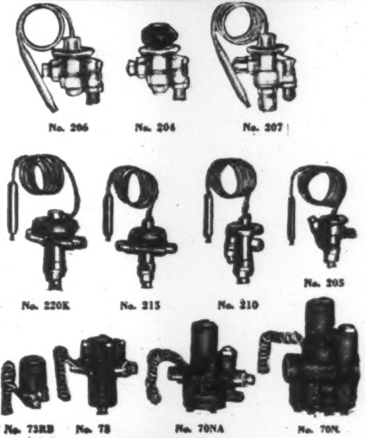


- Refrigeration Parts Jobbers, who recognize Quality, Stock A-P Valves. . . . And Refrigeration Service Engineers who appreciate the value of Dependable Service-free Installations USE ONLY A-P VALVES, and DEMAND them for every job.

●

- **Commercial Refrigerator Installation**
  By J. N. Rowse, Baltimore, Md.
  Distributor for
  Allied Store Utilities Co.,
  Subsidiary of Hussman-Ligonier
- **Refrigeration Unit —**
  Hussman-Ligonier
- **A-P Valves — Purchased through**
  Parks & Hull Appliance Corp.
  Baltimore, Md.

●



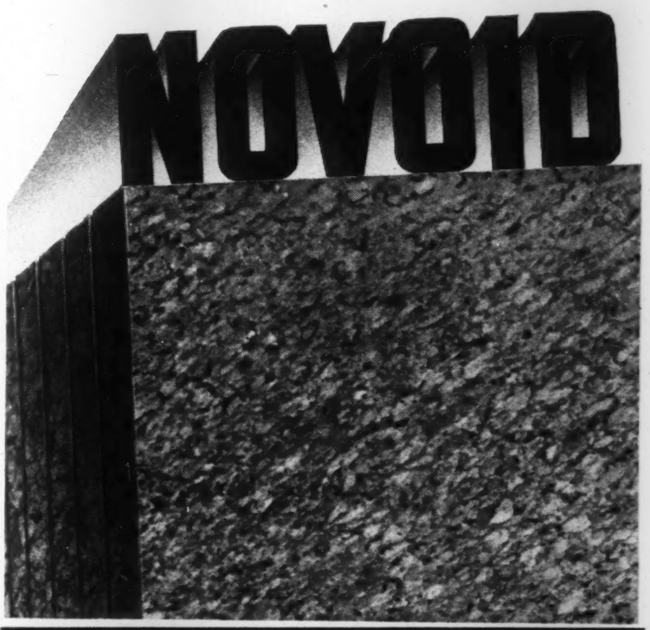
AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE WISCONSIN

DEPENDABLE

THE BYWORD FOR A-P CONTROLS

STEP UP

AIR CONDITIONING EFFICIENCY *with*



CORKBOARD INSULATION

COOL air is delivered more efficiently and economically when air ducts and other parts of air conditioning systems have the efficient protection of Novoid Cork Insulation. Made of pure cork, Novoid Corkboard and Novoid Cork Pipe Covering effectively retard the passage of heat and guard against condensation. Properly installed, this dependable cork insulation will provide years of low cost service.

In corkboard form, Novoid is quickly and easily applied to round, square, and rectangular ducts and to air washing rooms. It is light in weight, structurally strong, and available in a complete range of sizes. In the form of cork covering, Novoid is equally efficient as an insulation for cold water risers and return lines of air conditioning systems. It is carefully machined to fit pipes snugly, and moisture-proofed with an asphalt mastic coating.

It will pay you to find out all the facts about Novoid Corkboard and Novoid Cork Pipe Covering. For complete details, mail the coupon below.

CORK IMPORT CORPORATION
330 West 42nd Street, New York City

Cork Import Corporation, 330 West 42nd St., N. Y. C.
Please send me full information on Novoid Cork Insulation for air conditioning systems.

Name ....

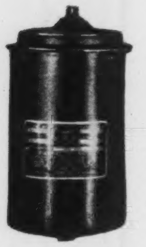
Street ....

City .... State..........

TALLMADGE

Zoned Controlled

HEATING



The sensitive PRESSURE BOX control actuates the Modulating Zone Control Valve in the Tallmadge Zoned Heating System, and holds the pressure for the entire floor in each zone to the predetermined limits for the amount of heat for which the zone is set.

BETTER HEATING AT LESS COST

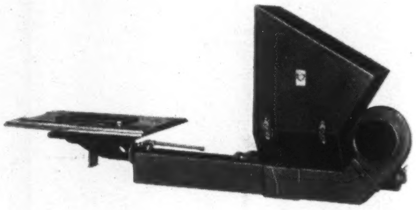
GIVES GREATER COMFORT

Improves Air Conditioning

VEBSTER TALLMADGE & CO.

NEW YORK CITY

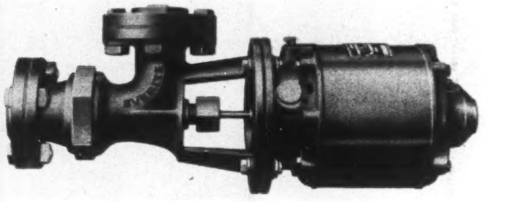
Adds New Stoker Model



No. 1571—With the announcement of a new "in-betwee model stoker, the manufacturer's line now offers models ran ing in coal feed from 10 to 1250 lb per hr.

The new model has an 800 lb capacity open type hopper, three feeds giving a range of 130 to 200 lb per hr, and is equipped with "free rolling" automotive type transmission, "Marvel" air volume control, electric safety "Shear-Pin" switch, and other features. With this addition, the total number of models in the line has been brough up to 22, which includes six bin feed models, nine closed hoppe domestic models, and seven stokers for commercial and industrial installations.—Econ-O-Col Stoker Div., Cotta Transmissio Corp., 2340-11th St., Rockford, Ill.

Circulators for Hot Water Heating



No. 1572—A new line of water circulators for hot water heating systems incorporates the following features: 1. Combined seal and stuffing box to prevent practically all leakage. 2. A "floating", open blade, bronze impeller to eliminate vibrator noise, reduce friction, minimize motor load and obviate the need for a bypass when the circulator is not operating. The impeller does not touch the housing at any point. 3. The motor has a built-in, automatic-reset, overload control and is designed so that the circulator may operate in either a vertical or horizontal position.

Low power consumption and freedom from radio interference are claimed for this circulator, which is made in four sizes, 1, 1¼, 1½ and 2 in.—Everite Pump & Mfg. Co., Inc., Lancaster, Pa.

Finish Protects Steel Conduit

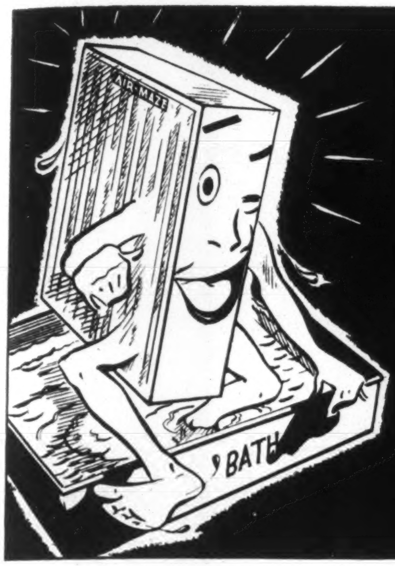
UNDERWRITERS LABORATORIES INC.
INSPECTED
RIGID STEEL CONDUIT

No. 1573—A new development in protecting steel conduit from corrosion is known as "Walkerizing", by which process a uniform coating of zinc is fused into the outside and inside walls of the steel tube. Over this is applied a second coating containing a new, inert substance, which offers strong resistance to acids, alkalis, and salt water, states the manufacturer.

This conduit may be used to advantage not only in industries and locations where chemical conditions create serious corrosion problems, but to assure longer service in all types of installations, it is said.—Walker Brothers, Conshohocken, Pa.

Pipe Joint Compound

No. 1574**—A liquid compound recently developed and placed on the market is intended for use as a permanent seal for joints and seams on equipment where gas, oil, steam, etc., are used.



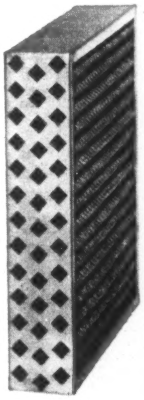
JUST LIKE NEW AGAIN

—after every cleaning!

AIR-MAZE permanent type air filter panels may be completely cleaned time and again during their long life;—and after each servicing they again have the performance and characteristics of new filters.

What economy! No replacement panels are needed as AIR-MAZE Filters should outlive the air conditioning systems in which they are used. Cleaning and "charging" are simple, economical operations, easily performed by anyone;—no special equipment or materials are required.

But economy, efficiency and trouble-free performance are only a few of the advantages of AIR-MAZE. The scientifically constructed all metal element is so designed that clogging cannot occur. The round wire baffles have no serrated edges to which lint or similar foreign matter can so cling as to prevent ready removal when cleaning.



AIR-MAZE panels can be supplied in any reasonable size and shape. Specify AIR-MAZE; you'll be pleased with results.

REMEMBER THESE FEATURES

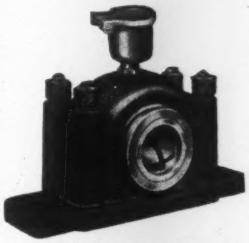
- 99.3% to 99.83% Efficient.
- Easily Cleaned, Charged.
- Very Low Pressure Drop.
- No Replacements Required.
- Long, Economical Service.

Let AIR-MAZE assist you with your air filter problems. Get the facts; write for bulletin PPS-38,—a helpful booklet which greatly simplifies filter installation planning.

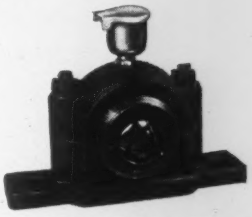
AIR-MAZE CORPORATION
5200 Harvard Ave. Cleveland, Ohio

AIR-MAZE
CLEANABLE AIR FILTER PANELS

OVER 500,000 *Randall* PILLOW BLOCKS IN SERVICE



Randall Universal Pillow Block—Has a double reservoir and can be mounted in any of four positions.



Randall D.R.O.R. Pillow Block—Has a double reservoir.

Today more than 500,000 Randall Pillow Blocks are giving efficient service in the field. They are evidence of quiet, long-lived, trouble-free operation.

You too, can be assured of the same consistent bearing operation in your units by installing Randall Pillow Blocks. We urge a trial as a means of proving to you that bearing troubles can be cut to the vanishing point with Randall Pillow Blocks.

Randall Pillow Blocks are built to last a lifetime. They are self-aligning, self-lubricating and operate with a minimum running torque.

Write for pillow block catalog describing in detail our complete line.

EASTERN STOCKS

Tek Bearing Co.
177 La Fayette
New York City

American Stock Gear Co.
100 St. Clair Ave., N. W.
Cleveland, Ohio

PACIFIC COAST STOCKS

Utility Fan Corp.
Los Angeles, Cal.

C. W. Marwedel
San Francisco, Cal.

***Randall* GRAPHITE PRODUCTS CORP.**
Dept. 1110 609 W. Lake St., Chicago, Ill.

AirMaster

GRILLES

A New, Easy Way to Select Grilles

The new AirMaster "Build Up" Selection Method makes it easy to select correct grilles for every type of outlet. Grilles, dampers and frames are all interchangeable, permitting innumerable combinations for every purpose — with return grille assemblies to match. The "Build Up" Selection Method saves you time and work — practically eliminates the need for costly special built jobs.

Advanced scientific AirMaster design assures the most flexible and complete control of air distribution ever developed.

Free Literature on "Build Up" Selection Method

Write for the newest AirMaster Catalog which gives complete information on the "Build Up" Selection Method and other advanced AirMaster features.

WATERLOO REGISTER CO.

Waterloo, Iowa **Seattle, Wash.**

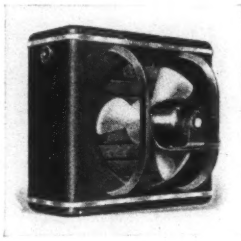
In New York City—Air Conditioning Utilities, 8 W. 40th St.

Among its applications are pipe threads, face joints, tank seams, compressors, gaskets, and valves, according to the maker.

Known as "Miccro" compound, it is insoluble in gasoline, oil, steam, "Freon," methyl chloride, ammonia, sulphur dioxide, and in many commercial solvents (alcohol excepted). It is applied with either a brush or the fingertips.—Michigan Chrome Co., 6340 E. Jefferson Ave., Detroit, Mich.

New Unit Heaters

No. 1575—Streamlined "eye appeal" has been added to the new "Model C Breezo-Fin" unit heater, according to the manufacturer. It is finished in a dull luster brown metallic color to resemble hammered copper and has been built to blend inconspicuously with varying backgrounds.



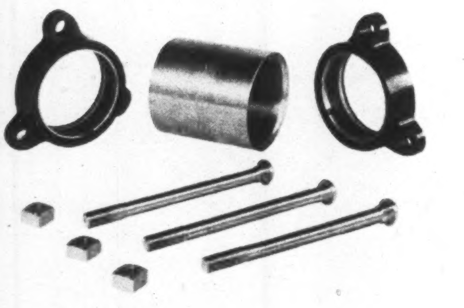
Changes have also been made in construction of the unit. The heater element is a one piece seamless copper tube with square copper fins spaced to give maximum radiation; for special process jobs where unusual conditions exist coils with fins spaced farther apart can be supplied. There is only an inlet and a discharge joint on the coil, both outside of the unit, to eliminate possibility of leakage inside the unit.

The casing is new and has no sharp corners, the fan has been slightly modified to give greater capacity with less air noise, a stronger, more rigid motor mounting is incorporated, and rubber silencers are provided on motor feet. New invisible threaded hangers at the top of the unit are designed to make installation easy and permit quick relocation.

There are five sizes of these units available ranging from 12 in. to 24 in., and each may be had with one or two row coils.—Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

Coupling for Plain End Pipe

No. 1576—The "Raybould" coupling illustrated is designed to furnish a simple and leak-proof method of joining plain end pipe. It consists of two resilient compression rings, metal bushed at either end, encased in two flanges or follower rings which bear against a center ring acting as a spacer between the flanges. The compression rings provide the sealing medium while the flanges sustain the mechanical forces applied in tightening up the coupling. In sizes smaller than 3 in. the flanges consist of two compression nuts and the coupling is fastened by tightening these nuts on a threaded center ring. Larger sizes employ long bolts and nuts to draw up the two flanges.



According to the maker, among the advantages of this coupling is that it is designed for high pressures, the contents of the pipe cannot contact with or deteriorate the compression ring, the joint is not affected by normal expansion, contraction or deflection, its use does not require any sizing operations on the ends of pipes, and minimum millivolt drop between pipe and coupling eliminates electrolytic action.—Pittsburgh Equitable Meter Co., 400 N. Lexington Ave., Pittsburgh, Pa.

HOW *Pensacola, Fla.* GOT MORE WATER FOR $3,000 A YEAR LESS COST

U. S. NAVY PHOTO—
Courtesy Pensacola Municipal Adv. Board

OLD WELLS and out of date pumping equipment could not produce an adequate supply of water. Power cost was excessive. The City of Pensacola was growing rapidly. Mains were being extended. Something had to be done.

Layne engineers surveyed the situation. Their recommendations were accepted. The Layne-Central Company (one of the Layne & Bowler, Inc., affiliates) installed and equipped a 26 inch well that gave Pensacola 3,600,000 gallons of water per day. Power cost alone, saved over $3,000.00 a year. Another 26 inch Layne Well was installed to give them a 100 per cent "standby" supply of water. Thus they are not only saving money, but are getting more and better water. Both wells are gravel wall, underreamed type and concrete sealed from strainer to ground level against seepage and unwanted intermediate water strata.

Wherever you go, you will find Layne Wells and Pumps giving complete satisfaction to cities and industries of all sizes. For literature that fully explains their many fine features address LAYNE & BOWLER, INC., Dept. K, Memphis, Tenn.

AFFILIATED COMPANIES

LAYNE-ARKANSAS CO.	STUTTGART, ARK.
LAYNE-ATLANTIC CO.	NORFOLK, VA.
LAYNE-CENTRAL CO.	MEMPHIS, TENN.
LAYNE-NORTHERN CO.	MISHAWAKA, IND.
LAYNE-LOUISIANA CO.	LAKE CHARLES, LA.
LAYNE-NEW YORK CO.	NEW YORK CITY AND PITTSBURGH, PA.
LAYNE-NORTHWEST CO.	MILWAUKEE, WIS.
LAYNE-OHIO CO.	COLUMBUS, OHIO
LAYNE-TEXAS CO.	HOUSTON AND DALLAS, TEXAS.
LAYNE-WESTERN CO.	KANSAS CITY, MO. CHICAGO, ILL., MINNEAPOLIS, MINN. AND OMAHA, NEBRASKA.
LAYNE-BOWLER NEW ENGLAND COMPANY	BOSTON, MASSACHUSETTS.
INTERNATIONAL WATER SUPPLY, LTD.	LONDON, ONTARIO, CANADA

LAYNE

PUMPS & WELL WATER SYSTEMS

For Municipalities, Industries, Railroads, Mines and Irrigation

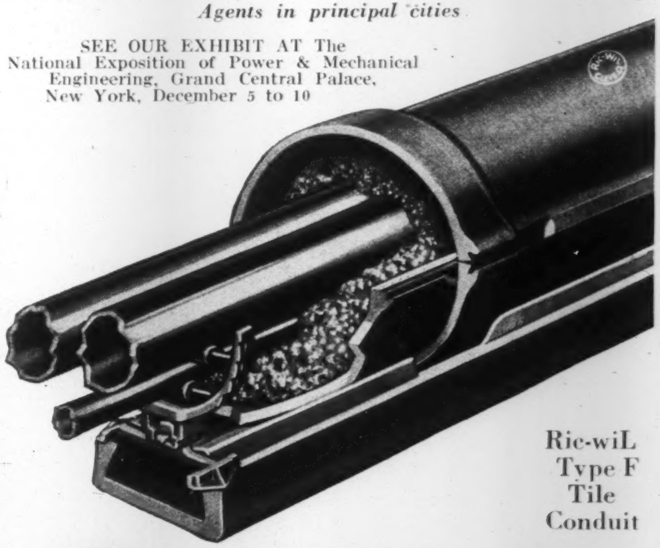
WHAT — NO WORD FROM MR. WATT?

WATT, who developed the steam engine, is doing no talking. He's now under the sod—and a lot of steam lines are in the same place. Watt perhaps never visualized underground steam conveyance. If he had, his genius would probably have immediately perceived the fundamental superiority of a Ric-wiL Conduit System. We might even have got a testimonial from him. But many competent engineering authorities who followed him *have* given unreserved approval to the design and construction of Ric-wiL Systems. *Their* advice should be valuable to you.

Ric-wiL Conduit for steam power and heating lines is a sectional system built of vitrified, glazed Tile (also furnished in Cast Iron and in Armco Iron Units). Standard Ric-wiL is insulated with patented Dry-paC Waterproof Asbestos, but loose commercial insulation or sectional pipe covering may be had if desired. Ric-wiL with Dry-paC, as proved by reliable tests, gives over 90% efficiency on the line. Upper and lower halves of Ric-wiL Conduit are interlocked by the Loc-liP cemented joint. End joints of conduit and base drain are staggered—another interlocking feature. Ric-wiL provides adequate drainage and entirely closed construction. Complete service on layout, manufacture, and installation. Write for latest bulletins.

The Ric-wiL Co., Union Commerce Bldg., Cleveland, O.
New York Chicago
Agents in principal cities

SEE OUR EXHIBIT AT The
National Exposition of Power & Mechanical
Engineering, Grand Central Palace,
New York, December 5 to 10



Ric-wiL
Type F
Tile
Conduit

REGISTERED IN U. S. PATENT OFFICE

RIC-WIL

CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

Faster-Better-Heating

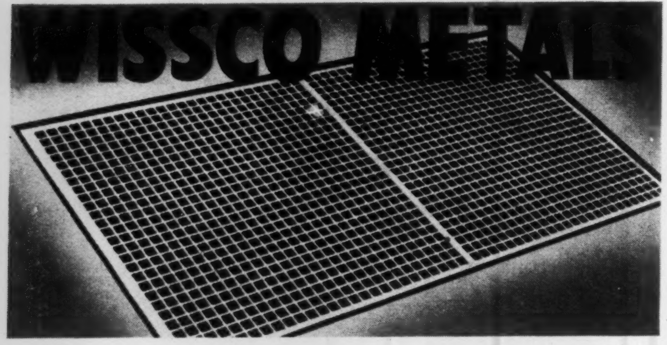
KRAMER UNIT HEATERS

• A quiet, low-cost, handsomely finished unit. Constructed for high pressure, durability and permanence •

Send for Bulletin

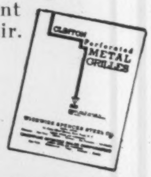
KRAMER TRENTON AUTO RADIATOR WORKS
TRENTON, N. J.

WISSCO METALS



LIE FLAT

Users of Decorative Perforated Metals who experience difficulty in working sheets that buckle or warp, will find Wissco ideal for their purposes. New processing machinery makes Wissco Perforated Metals lie flat. The designs are most attractive and give excellent concealment without undue restriction to the flow of air. Write today for full information.



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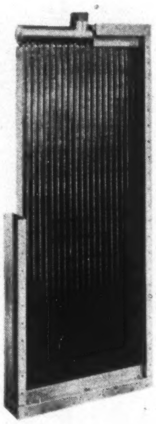
perforated metals

Copper Heating Surface

No. 1577—New "Series H" heating surface is a durable, light weight heating element of corrosion resisting copper and copper alloy which is efficient for all applications involving steam-to-air heat transfer, according to the manufacturer. It is a companion product to the maker's heating surface with steam distribution tubes for low pressure valve controlled installations requiring extreme controllability.



The new surface has been designed for general application with low and high pressure steam systems (up to 200 lb gage). It is available in a wide variety of sizes and capacities, there being seven distinct surface types, each of which is subdivided into eight fin widths and up to sixteen finned lengths—a total of 784 available sections.

The extended fins are of the flat plate type made from copper sheets, the steam condensing tubes are made of round seamless copper, and the steam and return headers are fabricated of heavy wall, seamless copper tubing, copper end caps, and brass connection nipples, the several parts being welded into an integral assembly. A feature of the headers is the extrusion of the tube connecting collars directly from the header body which is accomplished by a special manufacturing process.

The sections are furnished assembled in a 14 gage galvanneal steel casing with punched flanges to facilitate connection to duct work. The casing ends are die-formed to receive the cylindrical steam and return headers, which feature saves in over-all length of the section and adds casing strength, particularly where two or more sections are stacked vertically with tubes horizontal.—John J. Nesbitt, Inc., State Road and Rhawn St., Holmesburg, Philadelphia, Pa.

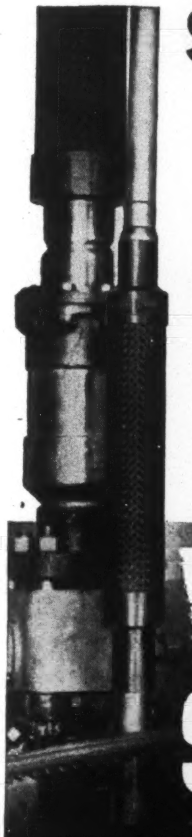
Booklets, Reports and Papers

Benefits of Office Building Air Conditioning

Writing in an issue of the *Real Estate Record* earlier this year (February 5, 1938, Vol. 141, No. 6) H. L. Schwenker, vice-president of the Lincoln Liberty Life Insurance Co., Lincoln, Neb., described the benefits of air conditioning of the Lincoln Liberty Life building. This building was completely remodeled in the fall of 1936 and opened to tenants as a modern air conditioned office structure. The total cost of modernization was about $180,000, of which the installation of air conditioning equipment accounted for $28,000.

After nearly eighteen months' experience as owner-occupants of an air conditioned building, it is the company's belief that one of the major benefits of air conditioning is given too little attention—that is the effect on the health of occupants. To illustrate, Mr. Schwenker says that during the winter of 1936 and early 1937 Lincoln suffered an epidemic of colds and influenza. In previous years, with moderate sickness records, absence of employees amounted to as much as 10 or 15 per cent. Last year, despite the epidemic, time lost through illness was negligible. This might be a coincidence, but Mr. Schwenker believes that air conditioning deserves most of the credit.

Another great benefit is air conditioning's cleaning function, which means comfort for the tenant and protection for his office equipment, as well as advantage to the landlord in lower maintenance cost. Air conditioning also tends to equalize the value



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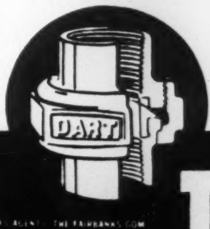

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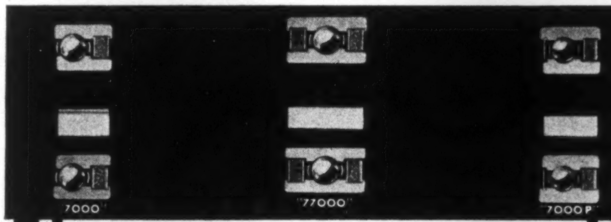

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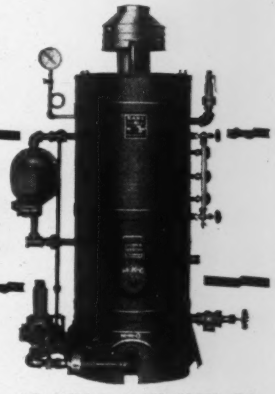

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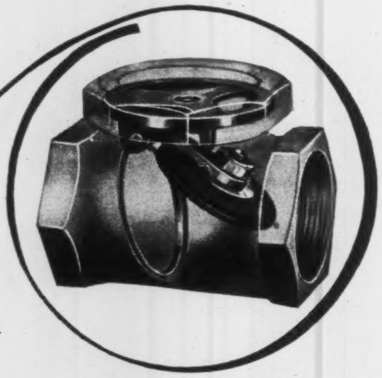

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Fairbanks Valves

of space throughout a building, making lower floors as desirable as higher ones. From the owner's standpoint, air conditioning also has an advantage in permitting more careful selection of tenants.

Mr. Schwenker strongly commends to other building owners the course they followed in buying air conditioning, as they believe their best investment was the money spent for the services of a consulting engineer who wrote the specifications for the equipment.

Comparison Charts for Planing Mill Exhausters and Cast Iron Volume Fans Offered

For the convenience of engineers and industrial buyers of fan equipment, the National Association of Fan Manufacturers, 5-208 General Motors Bldg., Detroit, Mich., has available for distribution a leaflet in which is tabulated fair comparison charts of planing mill exhausters and cast iron volume fans, as well as illustrating the standard methods for arrangement of drive and designation of direction of rotation and discharge.

These types of fans have many industrial applications, such as conveying materials, removing dust and factory waste, handling gases or fumes etc.

Schools and Study Courses

Ohio State Offers Welding Course

A new curriculum in Ohio State University's college of engineering leading to a degree in welding engineering is now being offered. Its administration is under the department of industrial engineering, which for a number of years has presented the shop courses in welding required by various curricula in the engineering college. Entrance requirements are the same as for the other curricula of the college of engineering and admissions will be in the hands of the Entrance Board at Ohio State, Columbus, Ohio, to which inquiries should be directed.

"The curriculum, embracing all branches of modern welding, such as electric, gas, resistance, etc., is an attempt to meet the need for a training for men desiring to specialize in this comparatively new technology," according to Dean Charles E. MacQuigg. "It seeks to supplement the training of civil, metallurgical, industrial, and mechanical engineers, each with some of the training of the others."

Book Reviews

Creep Data

[Volume on creep data, compiled by special section of the joint research committee of the American Society for Testing Materials and the American Society of Mechanical Engineers on the effect of temperature on the properties of metals. 1938. 864 pp., 8½ x 11 in., clothbound. Obtainable from American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Price, $12 in U. S. and Canada, $14 elsewhere.]

This volume is divided into three major sections on wrought steels and ferrous alloys, cast steels and ferrous alloys, and non-ferrous materials, each of the sections being subdivided into individual types, the first section consisting of 24 such subdivisions, the second of nine, and the third of four.

Each subdivision consists of tables, describing the steels considered, of individual logarithmic charts of stress and corre-

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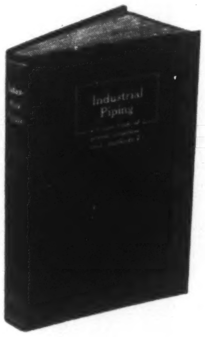

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There isn't a page in this book that won't give you one or more sound ideas you can put to immediate or future use in improving the efficiency of your own pipe lines. Priced at but $1, it is a rare buy in an engineering book. To get your copy, send $1.00 today to the address below.

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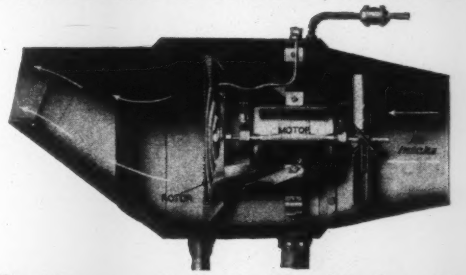

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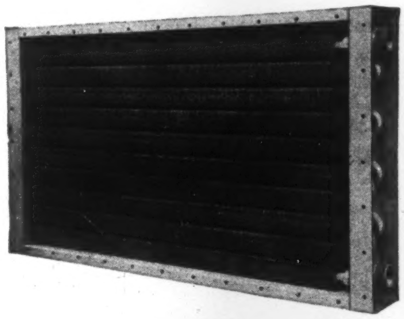

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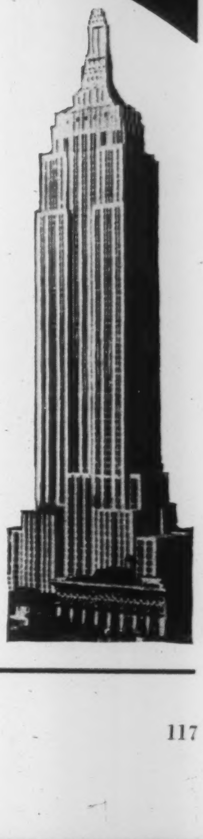

When architects and engineers select Patterson Indestructo Copper-Lined Hot Water Heaters for such a gigantic structure as the 1,248 ft. high Empire State Bldg., New York, it is a safe guide for you to follow.

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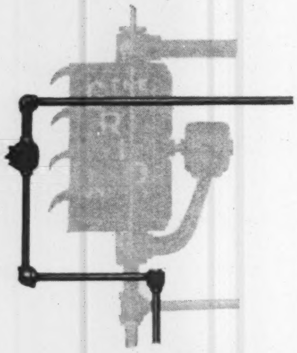

Can be attached either in front or behind the unit heater. To install, no air lines or extra piping other than small pipes for humidifier are necessary.

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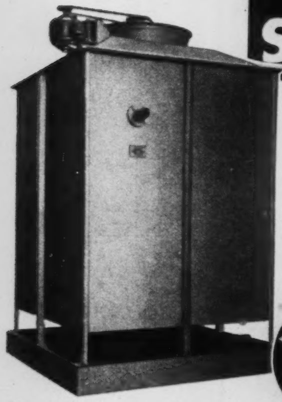

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sponding creep rate for each type of material at each temperature, of a plotting of temperature versus creep rate for each type of material whenever sufficient data were available, and of the standard tabulated forms which were prepared either by the various cooperating laboratories or from the data which they submitted.

This publication is intended to be of service to individuals and companies concerned with the design, construction and use of metals at intermediate and high temperatures.

Chemical Tables

["Chemical Tables from Handbook of Chemistry and Physics," 1st ed. 1938. 1383 pp., 5 x 7¼ in., bound in fabrikoid. Published by the Chemical Rubber Publishing Co., 1900 W. 112th St., Cleveland, Ohio. Price, $2.50 (50c additional in foreign countries).]

This book has been published to satisfy requests for a separate book of chemical tables taken from the widely used "Handbook of Chemistry and Physics." It is completely cross-indexed and divided into sections for quick reference. It includes a number of new tables and extensive revisions in various tables.

The general sections comprise mathematical tables, properties and physical constants, general chemical tables, specific gravity and properties of matter, heat, hygrometric and barometric tables, electricity, light, quantities and units, and miscellaneous.

Conventions and Expositions

Coal Conference: November 10-11, sponsored by West Virginia University, Morgantown, W. Va.

Air Hygiene Foundation: Annual meeting, November 17, Mellon Institute, Pittsburgh, Pa. Headquarters office, 4400 Fifth Ave., Pittsburgh, Pa.

Symposium on Air Conditioning: November 22, 7:30 p.m., Engineering Bldg., Chicago, Ill., sponsored by several societies and groups, and presided over by John Howatt. Subject of the meeting is air conditioning for human occupancy, and speakers are to include Philip Drinker, W. H. Carrier, Albert Buenger, Charles S. Leopold, Elliott Harrington, John R. Hertzler, and William B. Henderson.

American Society of Mechanical Engineers: Annual meeting, December 5-9, New York, N. Y. Headquarters office, 29 W. 39th St., New York, N. Y.

Power Show: National Exposition of Power and Mechanical Engineering, December 5-10, Grand Central Palace, New York, N. Y. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

American Society of Refrigerating Engineers: Annual meeting, December 6-8, Hotel Commodore, New York, N. Y. Headquarters office, 37 W. 39th St., New York, N. Y.

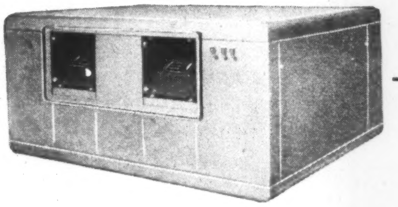
National Warm Air Heating and Air Conditioning Association: 25th anniversary convention, December 12-14, Netherland-Plaza Hotel, Cincinnati, Ohio, Managing Director, Allen W. Williams, 50 W. Broad St., Columbus, Ohio.

Refrigeration and Air Conditioning Accessories Exhibition: January 16-19, Stevens Hotel, Chicago, Ill. Manager and Committee Secretary, R. M. McClure, 111 W. Washington St., Chicago, Ill.

American Society of Heating and Ventilating Engineers: Annual meeting, January 23-26, William Penn Hotel, Pittsburgh, Pa. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

American Society of Mechanical Engineers: Spring meeting, February 23-25, New Orleans, La. Headquarters office, 29 W. 39th St., New York, N. Y.

American Society of Refrigerating Engineers: Spring meeting,



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This unit is ideal for year round air conditioning purposes. It it designed to heat, humidify, filter, and circulate the air in winter; cool, dehumidify, filter, and circulate air in summer. It is precision built, skillfully engineered, and very practical for stores, offices, cafes, theaters, shops, etc.

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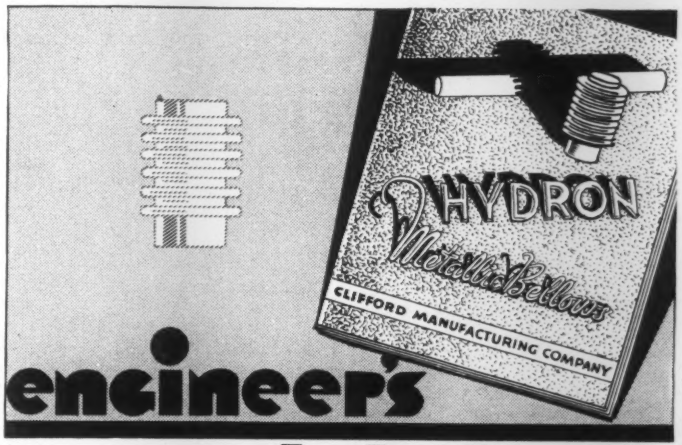

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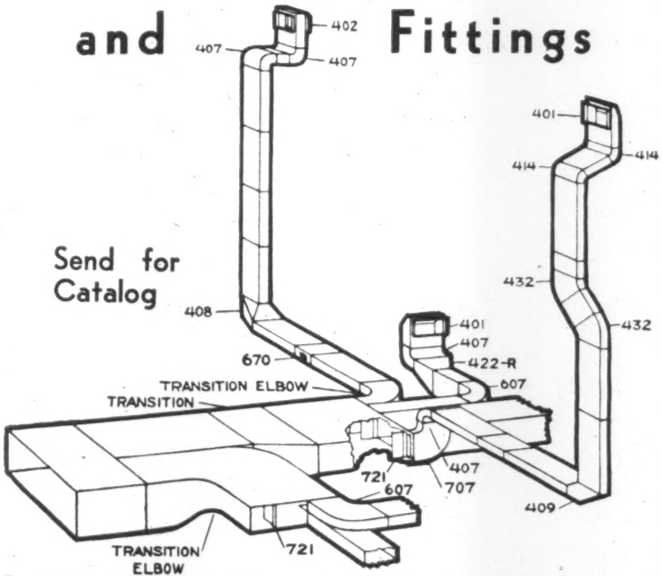

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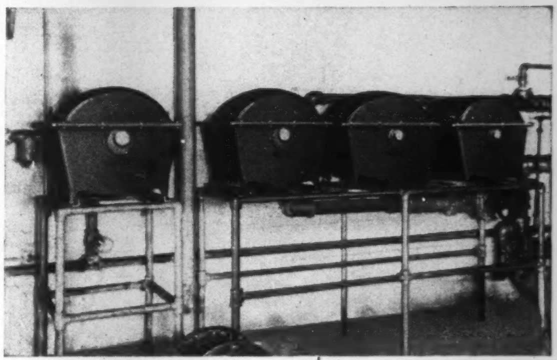

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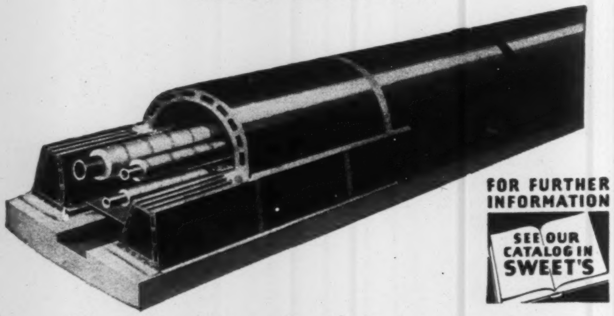

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Smoke Prevention Association: Annual convention and exhibit, June 13-16, Hotel Schroeder, Milwaukee, Wis. Headquarters office, 139 N. Clark St., Chicago, Ill.

International Acetylene Congress: 13th International Congress of Carbide, Acetylene, Oxy-Acetylene Welding and Allied Industries, June 25-July 1, Munich, Germany. International Acetylene Association, 30 E. 42nd St., New York, N. Y.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 122. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 2980. BEARINGS AND BUSHINGS: Federal-Mogul Corp., Detroit, Mich. 16 p. booklet on bearings, bushings and bearing metals for industrial application, describing various types in general use, newer types and methods of design and manufacture. A wide variety of modern bearing and bushing applications is illustrated.

No. 2981. CONSTANT PRESSURE VALVES: Fedders Mfg. Co., Inc., 57 Tonawanda St., Buffalo, N. Y. Issue of "Fedders News" (Vol. 5, No. 9) including article by Joe Askin on construction and uses of the constant pressure valve.

No. 2982. DIRECT EXPANSION COOLING SURFACE: Aerofin Corp., 410 S. Geddes St., Syracuse, N. Y. 51 p. technical catalog on direct expansion cooling surface, with description of various types of units, numerous examples worked out in detail showing method of selecting these units, performance tables and curves using "Freon" or methyl chloride, a psychrometric chart, and a direct expansion selection chart for coils.

No. 2983. HEATING EQUIPMENT MAINTENANCE: L. J. Wing Mfg. Co., 14th St. and 7th Ave., New York, N. Y. Heating equipment maintenance checking chart listing many subjects that may require attention before and during the heating season, with spaces left for checking those items found needing attention. One side of the chart is addressed to the executive and the other side to the maintenance man.

No. 2984. ICE MAKING EQUIPMENT: Frick Co., Waynesboro, Pa. 32 p. bulletin (127-F) on ice making equipment and systems, including the brine race system, submerged shell coolers, pipe coils, dual pressure plants, plants for one man operation, and various other arrangements and associated equipment.

No. 2985. INDOOR COMFORT: Julien P. Friez & Sons, Inc., 4 N. Central Ave., Baltimore, Md. 16 p. non-technical booklet addressed to operating executives or owners responsible for cost and general operation of air conditioning or automatic heating, giving highlights on indoor comfort, with particular attention to controls and instruments, how to conduct accurate surveys of air conditioning, capitalizing air conditioning by display, and how to centralize responsibility for air conditioning systems.

No. 2986. LEAD LINED EQUIPMENT: National Lead Co., 111 Broadway, New York, N. Y. Issue of "The Dutch Boy Quarterly" (Vol. 16, No. 3) containing fifth and concluding article of a series dealing with various types of lead equipment used in the chemical and acid industries.

No. 2987. MINERAL WOOL: National Mineral Wool Association, 1270 Sixth Ave., New York, N. Y. 4 p. Producers' Council Research Bulletin No. 28 on installation of mineral wool insulation by hand methods, presenting recommended practices and giving information on insulating value of mineral wool and vapor barriers.

No. 2988. MOTORS: Bodine Electric Co., 2254 W. Ohio

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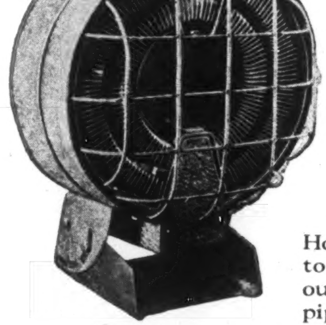

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These handy heaters make *any* heating job simple. No pipes to insulate, no valves or joints to leak. No pressure to keep up, either, which is another reason why users find them an economy, particularly in Spring and Fall, and for overtime work in office or shop.

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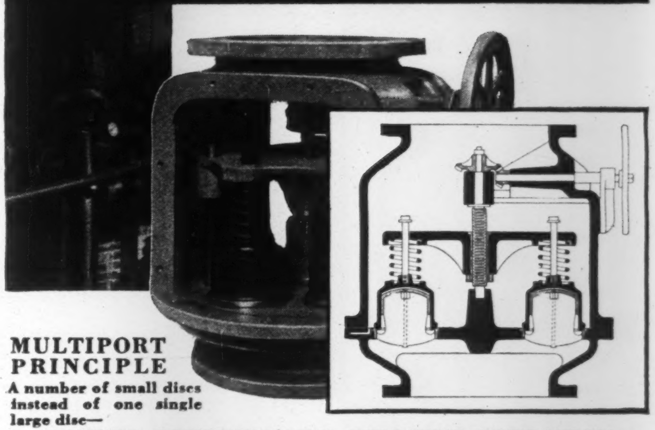
7610 Thomas Blvd. Pittsburgh, Pa.

Cannot Stick, Jam or Freeze



MULTIPORT PRINCIPLE
A number of small discs instead of one single large disc—

INSURES CONTINUOUSLY RELIABLE OPERATION

COCHRANE MULTIPORT RELIEF VALVE

The Cochrane Multiport Valve, for the control of atmospheric relief, back pressure, flow or check valve service, uses a multiplicity of small valve discs. These fit tightly against seats, yet are released freely; no possibility of jamming or freezing—no tendency for chatter or seat-pounding.

These valves are especially valuable for steam condenser service where positive tightness under high vacuum is vital. They are giving protection in more than 12,000 plants. If you want absolute insurance against damages from relief valves that now stick or jam, install Cochrane Multiport Valves. Write for copy of 16-page Publication No. 2710.

Cochrane Corporation, 3131 N. 17 St., Philadelphia, Pa.

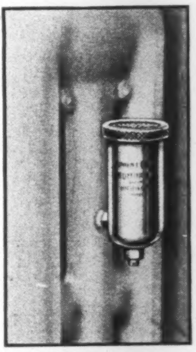
COCHRANE

VALVES · TRAPS · SEPARATORS · SPECIALTIES

DID YOU MAKE A NOTE OF THE IMPORTANT ANNOUNCEMENT ON PAGES 6 and 7?

Solve Your Problems *with* MAID-O'-MIST

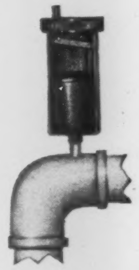
Automatic Humidifiers Automatic Air Vents



A complete line of:

Automatic Humidifiers for warm air, steam and hot water heating systems.

Automatic Air Vents for hot and cold water circulating lines, cooling units and hot water radiators.



No. 95 Auto-Vent Humidifier for steam radiators

Takes place of air valve. Automatically vents air from radiator and humidifies. Easily adjusted by set screw at bottom of valve.

The No. 7 Auto-Vent

Vents that high spot in the line or the concealed radiator and insures perfect circulation.

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• Keeps heat penetration at a minimum—makes air-duct systems more efficient. Shapes readily, very easy to apply.

THERMAL CONDUCTIVITY ONLY 0.246 BTU's

Gives lasting protection—won't rot or decay, repels vermin, resists fire and moisture. Comes in 3 thicknesses.

Write for samples.

• Also OZITE Air Duct Lining for elimination of noise and vibration.

AMERICAN HAIR & FELT COMPANY
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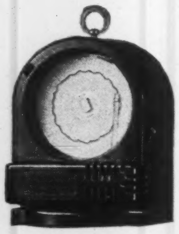
PERMANENT—WON'T ROT OR DECAY!


STOP GUESSING! GET THE FACTS ABOUT HEATING CONDITIONS

● Don't guess at heating conditions when you sell or service a heating plant. Use a Practical recording thermometer and get the facts. Endorsed by heating engineers. It gives you reliable temperature records on 24 hour charts. Portable, it can be used anywhere to check temperatures. Easy to use as an alarm clock. Only 7½ in. high. Sturdily built, low in price, and guaranteed. WRITE. Get complete information, specifications, price, and 15 DAY TRIAL OFFER. Ask your supplier or write to Practical Instrument Co., 2717F N. Ashland, Chicago.

NOW USE PRACTICAL THERMOMETERS BUY FROM YOUR SUPPLIER

Statement of Ownership and Management of Heating, Piping and Air Conditioning for October 1, 1938

The following is a statement of ownership, management, etc., as required by the Acts of Congress of August 24, 1912, and March 3, 1933, of HEATING, PIPING AND AIR CONDITIONING, published monthly at Chicago, Ill., for October 1, 1938:

State of Illinois, County of Cook, ss: Before me, a Notary Public in and for the State and county aforesaid, personally appeared F. P. Keeney, who, having been duly sworn according to law, deposes and says that he is the business manager of HEATING, PIPING AND AIR CONDITIONING, and that the following is, to the best of his knowledge and belief, a true statement of the ownership and management of the aforesaid publication, for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher, Keeney Publishing Company, Chicago, Illinois.
Editor, Chas. E. Price, Chicago, Illinois.
Managing Editor: C. M. Burnam, Jr., Chicago, Illinois.
Business Manager, F. P. Keeney, Chicago, Illinois.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

Keeney Publishing Company, 6 North Michigan Ave., Chicago, Illinois. Stockholders: F. P. Keeney, Chicago; W. J. Osborn, Fairfield, Conn.; R. Payne Wettstein, Chicago; Chas. E. Price, Chicago; Robert A. Jack, Cleveland Heights, Ohio.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting is given; also that the said two paragraphs contain statements embracing affiant's full knowledge, and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

F. P. Keeney,
Business Manager.

Sworn to and subscribed before me this 30th day of September, 1938.
[My commission expires Feb. 10, 1942.] Grace E. Waymire,
(SEAL) Notary Public.

FOR YOUR CONVENIENCE

Heating, Piping and Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [11-38]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" "and Recent Trade Literature." (Circle the numbers in which you are interested):

1562	1563	1564	1565	1566	1567	1568
1569	1570	1571	1572	1573	1574	1575
1576	1577					
2980	2981	2982	2983	2984	2985	2986
2987	2988	2989	2990	2991	2992	2993
2994	2995	2996	2997			

Name ....Title ....

Company ....

Address ....

City ....State..........

St., Chicago, Ill. 4 p. issue of "The Motorgram" (Vol. 18, No. 4) including an article on characteristics and applications of the governor motor.

No. 2989. REFRIGERATING UNITS: Frick Co., Waynesboro, Pa. Series of 2 p. data sheets on low pressure refrigerating units, listing specifications and giving data and dimensions for the various air cooled and water cooled types.

No. 2990. SOLENOID VALVES: Automatic Switch Co., 154 Grand St., New York, N. Y. Looseleaf catalog on "Asco" solenoid valves for steam, gas, liquids and air, with information on service recommendations, general specifications, installation and maintenance, and detailed data on various types for the different services and applications.

No. 2991. SOLENOID VALVES: Davis Regulator Co., 2546 S. Washtenaw Ave., Chicago, Ill. Looseleaf bulletin (S1) illustrating and describing solenoid valves which can be used for automatic control service on heating systems, container filling equipment, feedwater make-up lines, refrigeration systems, fuel lines, etc. The types listed are for general service on steam, air, gas and liquids.

No. 2992. TUBULAR PRODUCTS: Cohoes Rolling Mill Co., Canvass and Cortland Sts., Cohoes, N. Y. 102 p. handbook and price list on tubular products, including wrought iron pipe, "Mohawk" rigid steel conduit, and "Mohawk" steel pipe. Methods of manufacture, uses, welding, finishing pipe and inspection, and identification are discussed, and useful tables of technical and engineering data, symbols, etc., are included.

No. 2993. UNIT HEATERS: Carrier Corp., Syracuse, N. Y. 16 p. bulletin on unit heaters, with illustrations and diagrams, giving information on capacities, pipe sizes, ratings, etc. Several new types of units are included.

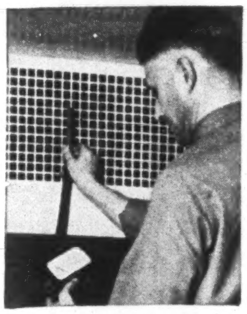
No. 2994. UNIT HEATERS: Fedders Mfg. Co., 57 Tonawanda St., Buffalo, N. Y. 12 p. bulletin (573) on "Series 4" unit heaters, describing new features of construction and giving tables of capacity data, dimensional data, piping diagrams, etc.

No. 2995. UNIT HEATERS: National Radiator Corp., 221 Central Ave., Johnstown, Pa. 8 p. bulletin on unit heaters, both single fan and double fan types, with information on applications, piping, ratings, dimensions and selection.

No. 2996. WATER COOLING EQUIPMENT: Marley Co., 3001 Fairfax Rd., Kansas City, Kans. 8 p. bulletin on the organization and facilities behind the manufacturer's water cooling equipment, with portraits of various members of the organization and illustrations of plant and office facilities.

No. 2997. WELDING: Mahoning Paint & Oil Co., Youngstown, Ohio. Leaflet on "Spatter-Nox" which is brushed or sprayed over the area which may be affected by spatter formation in metallic arc welding, and is said to reduce weld cleaning time 50 to 75 per cent.

CHECK YOUR HEATING INSTALLATIONS WITH THE



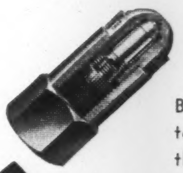
"ALNOR" VELOMETER

This all-purpose air velocity meter indicates air velocities directly and instantaneously on the scale in f.p.m. without the necessity of timing or mathematical calculations. Standard range 0-300, 0-3000 f.p.m. Other ranges available up to 18,000 f.p.m.

Write us today for a folder giving more complete information.

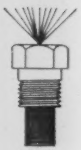
ILLINOIS TESTING LABORATORIES, INC.
412 N. LaSalle Street Chicago, Illinois

MONARCH SPRAY NOZZLES



¼" Fig. F-27

Both nozzles illustrated are used extensively for air conditioning units as they produce the finest spray possible with direct pressure. Capacities start at .57 g.p.h. at 40 lbs. Most popular size produces 2.25 g.p.h. at 25 lbs. and very wide (120°) angle spray.

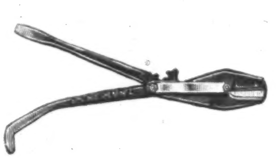


¼" Fig. H-261

CATALOG 6-A

MONARCH MFG. WKS., INC.
2728 E. WESTMORELAND ST., PHILADELPHIA, PA.

BENDING BRAKES **WHITNEY-JENSEN** METAL TOOLS

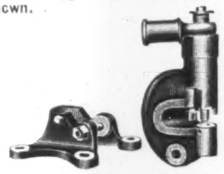


No. 20 PUNCH

- (Below) A heavy ball-bearing type Punch with powerful screw press action, giving greatest power with least weight. Capacity ½" hole in ½" iron. Bench base shown.

No. 2 SHEAR

- (Above) Special eccentric gear delivers same cutting power at blade tips as at throat. Will slit large sheets. Inserted, renewable tool steel blades. Capacity ⅛" iron.



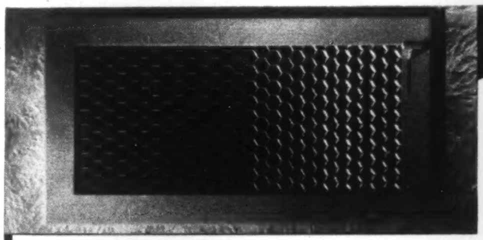
WHITNEY METAL TOOL CO. • 180 Forbes Street, Rockford, Illinois

REMPE

—experience really means something in certainty of results when it comes to Fin Coils and Unit Coolers

COILS

Ask **REMPE CO.,** 340 N. Sacramento Blvd., CHICAGO
Now stocked by Leo S. Bosarge Company, 315 Spring Street, N. W., Atlanta, Georgia



H&C

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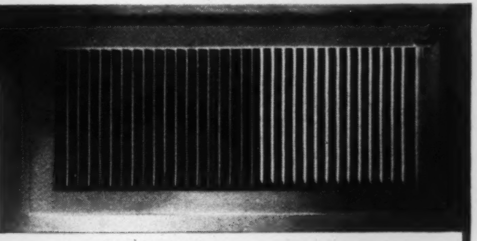
A QUALITY line that offers a design to exactly fit each requirement of price and performance.

Write for Catalog 37 A.C. and name of nearest jobber.

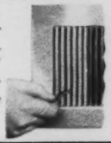


No. 90 DESIGN Aristocrat of Air Conditioning Grilles

With any of the wide range of sideway deflections in which it is available, air leaves grille on horizontal plane; no streaked ceilings. Curved tubular openings and 1" depth insure accurate control of air flow, provide many other desirable features.

No. 84 DESIGN Sectionally Adjustable

Quickly adjusted to any deflection by key provided. Moving one bar adjusts entire 2" section. Adjustment may be permanently locked in place.



HART & COOLEY MANUFACTURING CO., 61 W. KINZIE ST., CHICAGO, ILL.

CLASSIFIED ADVERTISING

8 cents for each word including heading and address. Count nine words for keyed address. Minimum $2.00 for each insertion. One inch $4.00. Cash must accompany order. Copy must be in our hands by the twenty-fifth of the month previous to issue.

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SALESMEN WANTED—One of the largest and oldest manufacturers in the heating and air conditioning industry has openings for experienced, aggressive salesmen in the following territories: 1. Southwestern States; 2. Midwestern States; 3. Atlantic Seaboard. Complete line of nationally advertised coal, oil and gas-fired equipment, also registers, grilles, prefabricated and gravity furnace pipe and fittings. Warehouse stocks adjacent to Midwestern and Atlantic Seaboard territories. Give complete information in first letter, including previous experience, sales record, references and acquaintance with heating trade. Include recent snap-shot photo, if available. Address Key No. 303-A, Heating, Piping and Air Conditioning, 6 No. Michigan Ave., Chicago, Illinois.

WANTED

Sales Engineer wants additional line of stampings, forgings, plastics, accessories or equipment for midwest territory. Address Key No. 302-A, Heating, Piping and Air Conditioning, 6 No. Michigan Ave., Chicago, Illinois.

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Non-Freeze
Uniform Temperatures
using
AEROFIN HEAT EXCHANGE SURFACE

NOW you may place heating coils in the cold air stream and obtain uniform temperature over the entire face of the coils even when steam is throttled for partial loads during freezing weather. The unique dual-tube design of this newest Aerofin development distributes steam so that stratification is prevented over the face of the coils at any percentage of heating capacity.

The new Aerofin Non-Freeze Heat Exchange Surface introduces steam from an inner tube, through orifices into the outer tube. The supply and return are located at the same end of the unit. In this way, the condensed steam flows back around the heated inner tube, preventing the condensate from freezing. This allows any degree of steam throttling without danger of freezing.

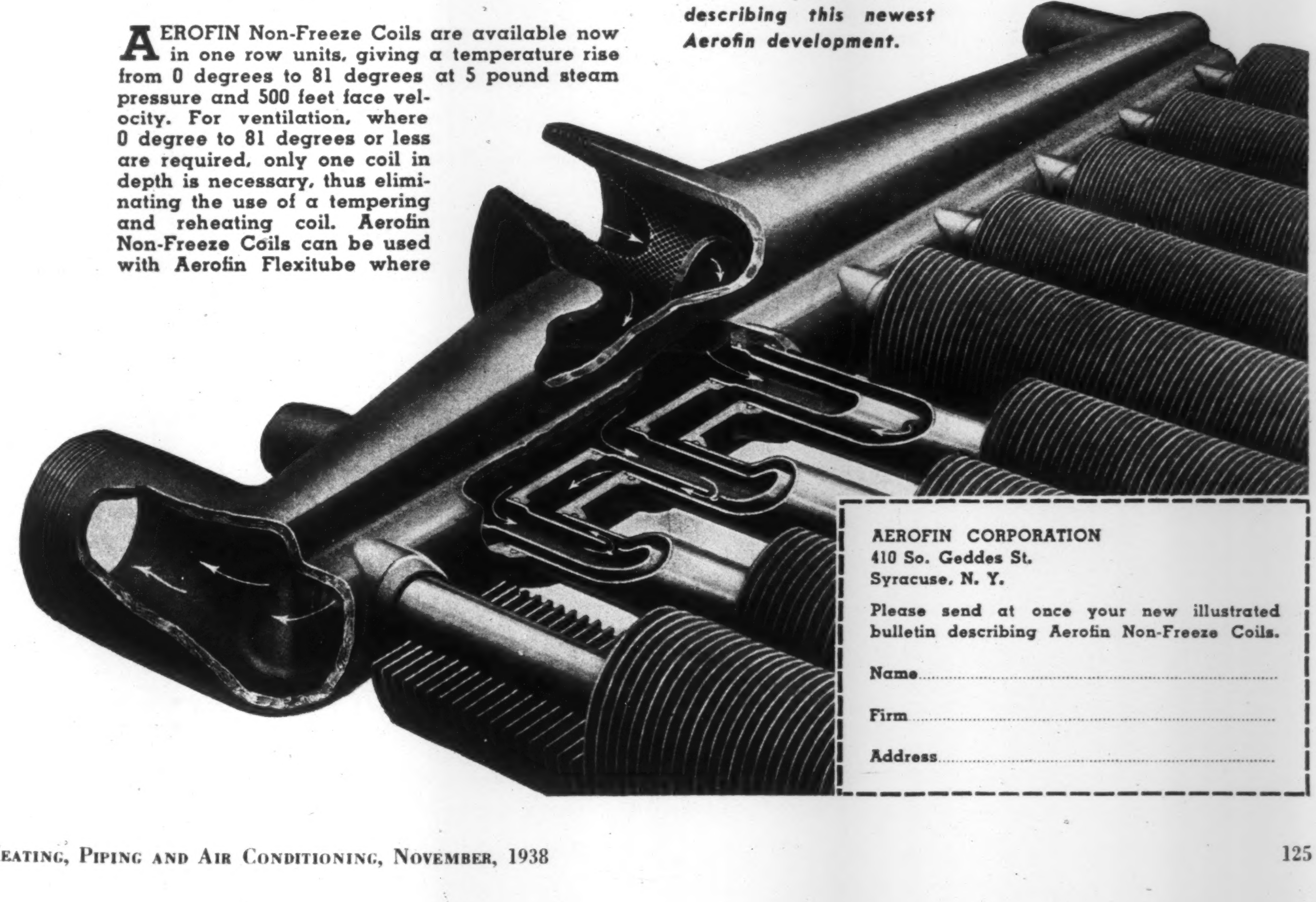
As an economy result, the necessity for using a separate tempering coil is eliminated, reducing the number of valves, traps and piping; and control is greatly simplified.

AEROFIN Non-Freeze Coils are available now in one row units, giving a temperature rise from 0 degrees to 81 degrees at 5 pound steam pressure and 500 feet face velocity. For ventilation, where 0 degree to 81 degrees or less are required, only one coil in depth is necessary, thus eliminating the use of a tempering and reheating coil. Aerofin Non-Freeze Coils can be used with Aerofin Flexitube where higher temperature rises are desired. Casings are of galvanized iron flanged for direct duct connections in Aerofin standard sizes. Overall casing dimensions are the same as Aerofin Flexitube, except for depth in direction of air flow. The depth of the coil casing is 5 inches instead of the standard 10 inch depth for Aerofin units.

All piping strains are transmitted to the casings without imposing any strains on the core. Each tube is free to expand or contract independent of adjacent tubes. Cores are pitched in the casings, allowing units to be installed in any position without pitching the heater casings.

These provisions for assurance of continuous heating without danger of freezing are available only in Aerofin Non-Freeze Coils.

Request your copy of the Descriptive Bulletin describing this newest Aerofin development.



AEROFIN CORPORATION
410 So. Geddes St.
Syracuse, N. Y.

Please send at once your new illustrated bulletin describing Aerofin Non-Freeze Coils.

Name...

Firm...

Address...

Here's Why it Pays to Install

STURTEVANT REXVANE HEATERS

1. **GUARANTEED FOR 200 POUNDS PRESSURE**
   And suitable for all steam pressures up to 200 pounds.
2. **LOW FINAL TEMPERATURES**
   Assure comfort for people near heaters.
3. **GUARANTEED CAPACITIES**
   In accordance with A. S. H. V. E. requirements.
4. **WIDE RANGE OF SIZES**
   Up to 1,421,000 B.T.U. (Standard rating.)
5. **FLEXIBILITY OF APPLICATION**
   All sizes available for either floor, wall or ceiling installation—belt or direct drive.
6. **HIGH EFFICIENCY**
   Large air volume handled with comparative quietness—at high efficiency—and extremely low horse-power.
7. **TIME-SAVING INSTALLATION**
   Sectional construction permits reversal of fan, heating, and center units to meet unexpected piping or other conditions on job.
8. **THERMADJUST CONTROL**
   Optional; either automatic or manual operation.
9. **THREE-BEARING CONSTRUCTION**
   Assures long shaft life. Center bearing easily re-aligned on the job by any mechanic.

We invite you to investigate these Sturtevant Rexvane Heater advantages. Phone our nearest office—or write for Catalog 395-3.

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Branch Offices in 40 Cities
B. F. Sturtevant Co. of Canada, Ltd., Galt, Toronto, Montreal

7 Rexvane Heaters selected for Apex Building, Washington, D. C.

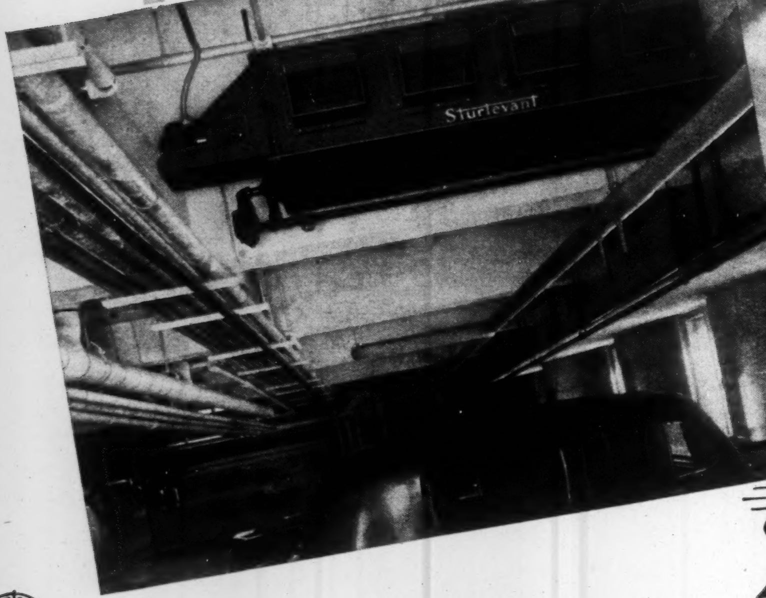
Installed in basement garage for general heating and to kill cold drafts at doors.

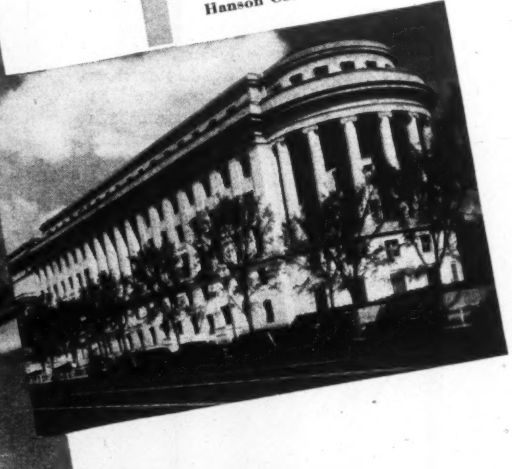
Deliver total of 1,730,500 B.T.U. and 25,500 C.F.M.

Architect: Bennett, Parsons & Frost, Chicago, in consultation with Procurement Division, Public Works Branch, U. S. Treasury Dept.

General Contractor: McCloskey & Co.

Mechanical Contractor: Mehring & Hanson Co.





Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

Fans, Blowers, Air Washers, Air Conditioning, Heating, Vacuum Cleaning, Drying, Mechanical Draft Equipment

You, too, would install Modern Pipe in this Building

REG. U. S. PAT. OFF.
REPUBLIC
STEEL
REG. U. S. PAT. OFF.

TONCAN
COPPER
MO-LYB-DEN-UM
IRON
—the alloy of refined open-hearth iron, copper and molybdenum with the greatest rust-resistance of any ferrous material in its price class.

● When you install Toncan Iron Pipe in a heating system—as was done by the contractor for the new Denver store and office building below—you need never hesitate to assure the owner that the piping will render trouble-free service for many years to come.

This iron-copper-molybdenum alloy resists rust and corrosion better than any other ferrous material in its price class. Thirty years of performance has proved this statement . . . and each year adds fresh laurels to the record.

In addition to providing you with pipe that you can recommend and install with full knowledge that its service will back up your assurance of long life and low cost per year, Toncan Iron offers another advantage. It is easy to work.

Write for a copy of "Toncan Iron Pipe for Permanence." It contains the complete story. Ask us at the same time for information on Republic steel pipe and on Toncan Iron and steel sheets. Republic Steel Corp., Cleveland, O.

REPUBLIC STEEL

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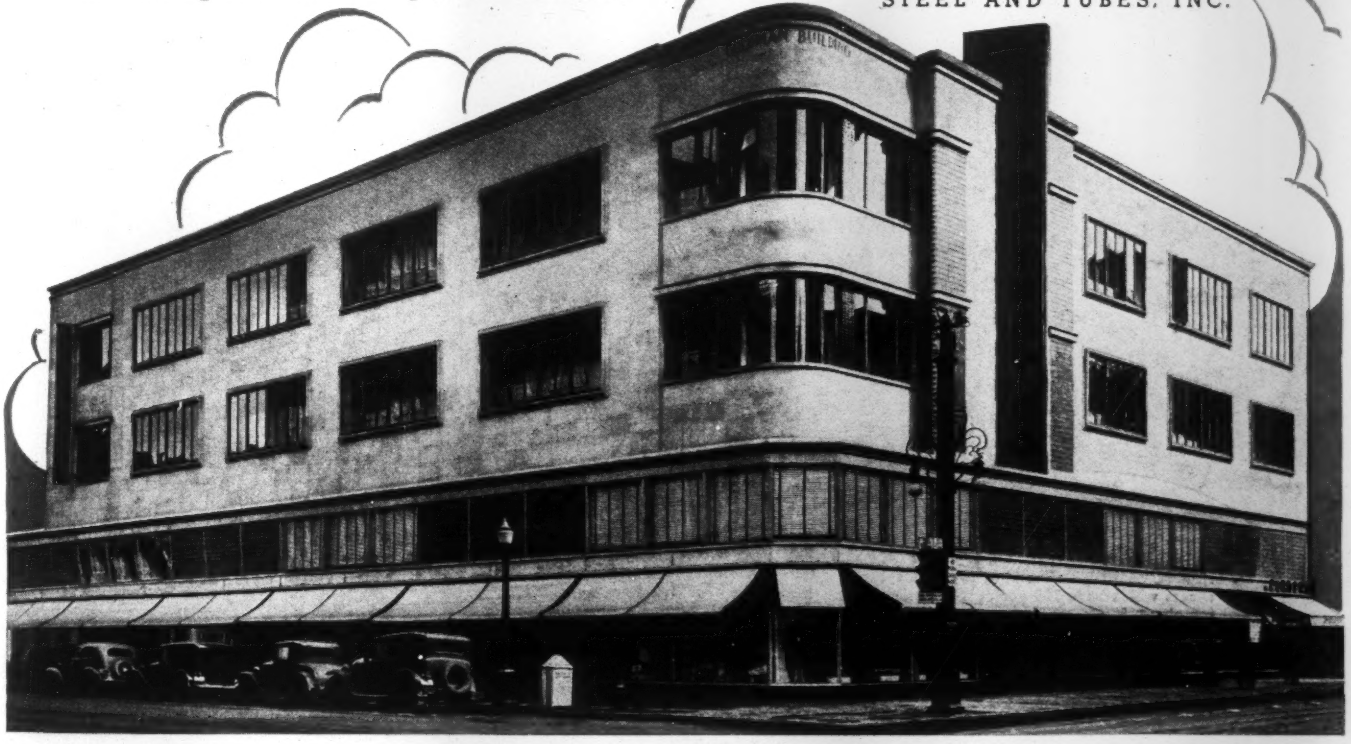
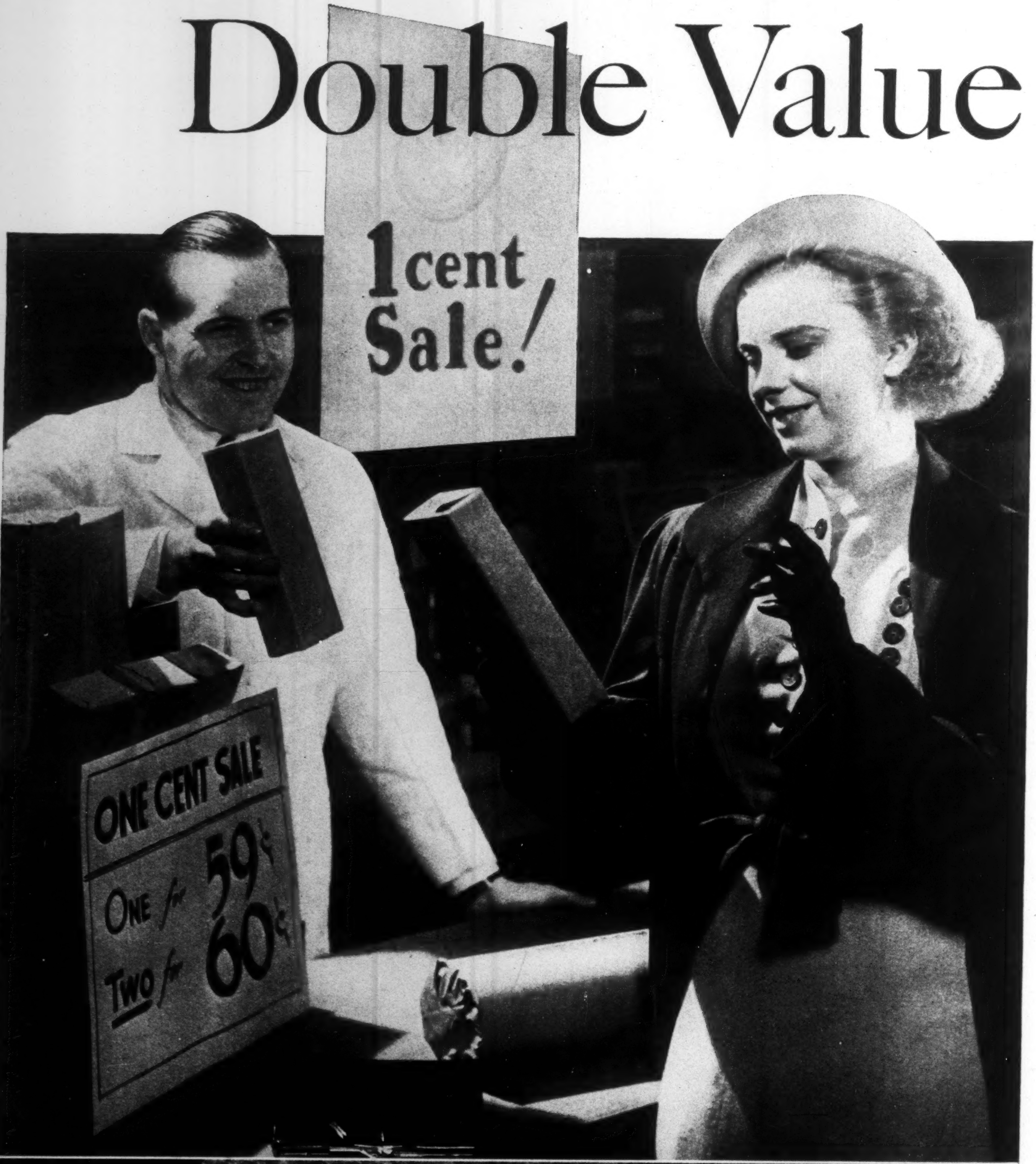
NILES STEEL PRODUCTS DIVISION
BERGER MANUFACTURING DIVISION
TRUSCON STEEL COMPANY
STEEL AND TUBES, INC.



When writing Republic Steel Corporation for further information, please address Department HP.

Double Value



U·S·S
COPPER STEEL

HOW MUCH DOES U·S·S COPPER STEEL COST? You can buy copper steel sheets which have 100 per cent more life for about 5 per cent more in cost than ordinary steel sheets.

HEATING, PIPING and AIR CONDITIONING, published monthly by Keeney Publishing Co., 6 N. Michigan Ave., Chicago, Ill. Subscription rates: U. S. and possessions, Canada, Mexico, Central America, South America, $2.00 per year; other, $4.00. Current copies, U. S. and possessions, 25 cents. Back numbers, 50 cents. December, 1938. Vol. 16, No. 12. Entered as Second Class matter May 18, 1929, at the Post Office at Chicago, Illinois, under the act of March 3, 1879.

for a "*Copper*"

. . . and a little copper doubles the value of steel

EASY FORMING SAVES TIME. U·S·S Copper Steel Sheets are being made softer and more ductile for better workability.

ONE cent sales have been remarkably successful because they give double value. Any customer can see that twice the amount of a product lasts twice as long.

In the steel industry, it is a "One cent sale" every time you buy U·S·S Copper Steel—for copper steel lasts more than twice as long as plain steel, yet it costs but little more.

When a product must be protected against rust at low cost, build it of U·S·S Copper Steel. For heating and air conditioning systems and equipment, this metal has proved to be the best obtainable. It not only lasts longer but it keeps fabrication costs down.

U·S·S Copper Steel is easy to work in both black and galvanized sheets. It can be readily formed, welded, drawn, cut and soldered.

Order U·S·S Copper Steel Sheets from our distributor in your territory. He can give you quick deliveries of all standard sheets.

• • •

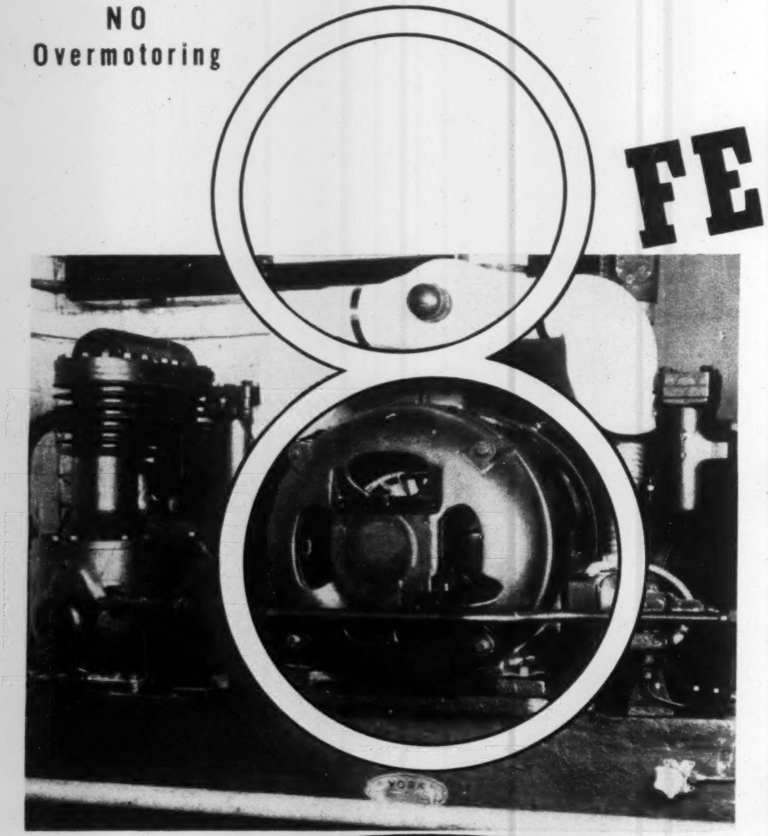
SEVERE BENDING is possible with U·S·S Tight Galvanized Sheets. You can be sure that every sheet bearing the U·S·S label will roll easily without fluting or flaking.

U·S·S COPPER STEEL SHEETS

CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*
United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

NO Overmotoring



FEATURES

in

Century

TYPE SCH

POLYPHASE MOTORS

THAT GIVE YOU LOWER COST, MORE EFFICIENT

AIR CONDITIONING PERFORMANCE . . .

FEATURE 1. Here is a motor that has the necessary high torque to start, and bring the refrigeration compressor up to full speed without overmotoring the running load—that's the experience in thousands of installations. This one point alone is highly important in getting the most out of motor performance in air conditioning.

For details on these other features ask the Century representative nearest you.

2. This high break away torque is generally sufficient where reasonable variations from normal conditions obtain in the installation.
3. Locked rotor or starting currents in conformity to E.E.I. and N.E.M.A. limits.
4. Unusually quiet starting. No grunts or groans. Starting noises create uncomfortable air conditioning just as much as noise in running.
5. Unusually Quiet Running.
6. Long life, because of excellent mechanical construction and electrical insulation.
7. Easy to keep clean outside — keeps itself clean inside.
8. Good appearance to match modern compressor design.

Be sure that you get maximum motor performance in every air conditioning installation—see the Century representative in your locality—do this now before you make that motor investment.

CENTURY ELECTRIC COMPANY
1806 Pine Street • • • St. Louis, Mo.
Offices and Stock Points in Principal Cities

Atlanta • Baltimore • Boston • Buffalo • Chicago • Charlotte • Cincinnati • Cleveland • Dallas Denver • Davenport • Detroit • Houston • Indianapolis • Kalamazoo • Kansas City • Los Angeles • Milwaukee • Minneapolis • New Orleans • New York • Omaha • Philadelphia Pittsburgh • Rochester • Salt Lake City • San Francisco • Spokane • Seattle • Tulsa

Century MOTORS

ONE OF THE LARGEST EXCLUSIVE MOTOR MANUFACTURERS IN THE WORLD

PREST-O-LITE ACETYLENE

is convenient for use in all

OXY-ACETYLENE PROCESS APPLICATIONS

P X272146 WK
231
THE PREST-O-LITE CO. INC.
ICC-8
4T37
THIS CYLINDER CONTAINS
PREST-O-LITE
ACETYLENE
CLOSE VALVE WHEN EMPTY

Prest-O-Lite dissolved acetylene — made from Union Carbide—is especially convenient for all oxy-acetylene process applications that do not justify the installation of an acetylene generator. Obtainable from hundreds of stock points throughout the country, Prest-O-Lite acetylene is always available for instant use with any make or type of oxy-acetylene equipment.

The same sales and service organization that is back of Prest-O-Lite dissolved acetylene also is prepared to supply you with Linde oxygen, Oxweld apparatus and supplies, and Union Carbide. Thus, no matter what your interest in the oxy-acetylene process may be—whether in production, repair or new construction—you can coordinate your requirements for materials and service through Linde.

The Linde sales, engineering, and service facilities can assist you in welding, cutting, flame hardening, flame softening, hard-facing or in any other application of the oxy-acetylene process peculiar to your business. Write to The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, New York and principal cities.

The words "Linde," "Prest-O-Lite," "Oxweld" and "Union" used herein are registered trade-marks.

Full Before They are Filled!

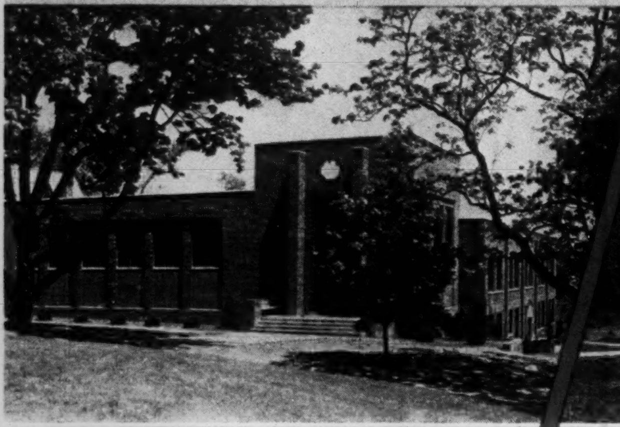
Few products require a container comparable to a Prest-O-Lite acetylene cylinder. Before it receives acetylene, each cylinder must be tested and filled with a porous material saturated with acetone, a liquid capable of absorbing many times its own volume of acetylene. In service, an exact life record must be maintained for each cylinder, and frequent and rigid inspections continued.

Everything for Oxy-Acetylene Welding and Cutting

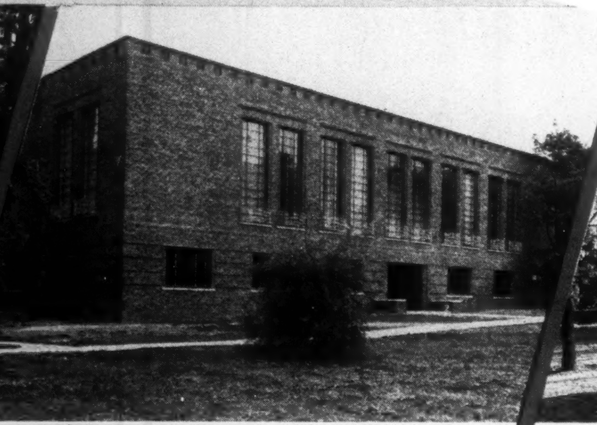
FROM PRODUCTS OF UNITS OF UCC UNION CARBIDE AND CARBON CORPORATION LINDE

LINDE OXYGEN • PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES • UNION CARBIDE

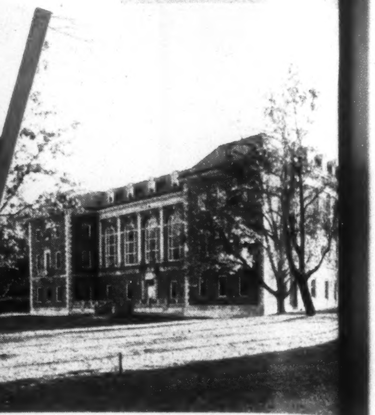
AUTOMATIC TEMPERATURE CONTROL BY JOHNSON



Above: Law Bldg., University of Kentucky

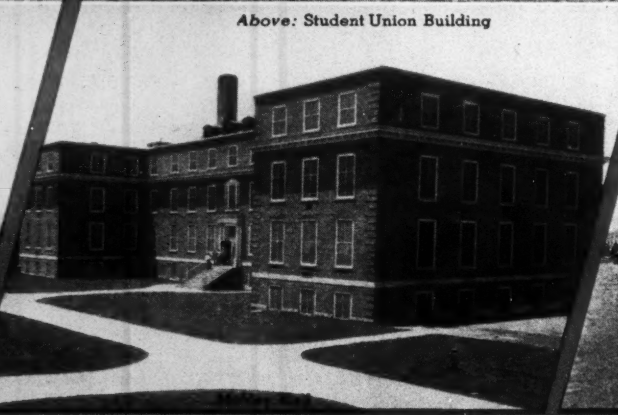


Above: Student Union Building

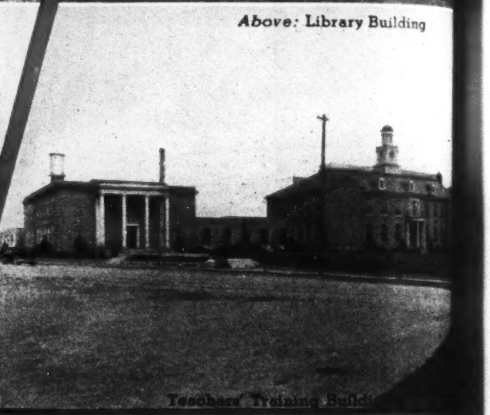


Above: Library Building

West Unit, Engineering Building



McVey Hall



Teachers' Training Buildi

THROUGHOUT THE CAMPUSES OF MANY INSTITUTION

And the University of Kentucky, Lexington, is a good example! Johnson automatic temperature control, with individual thermostats in each principal room, is employed in the Teachers' Training Building, the Library, McVey Hall, and the Dairy Products Building. The other buildings, pictured here, and several others as well, are equipped with Johnson-controlled ventilating systems.

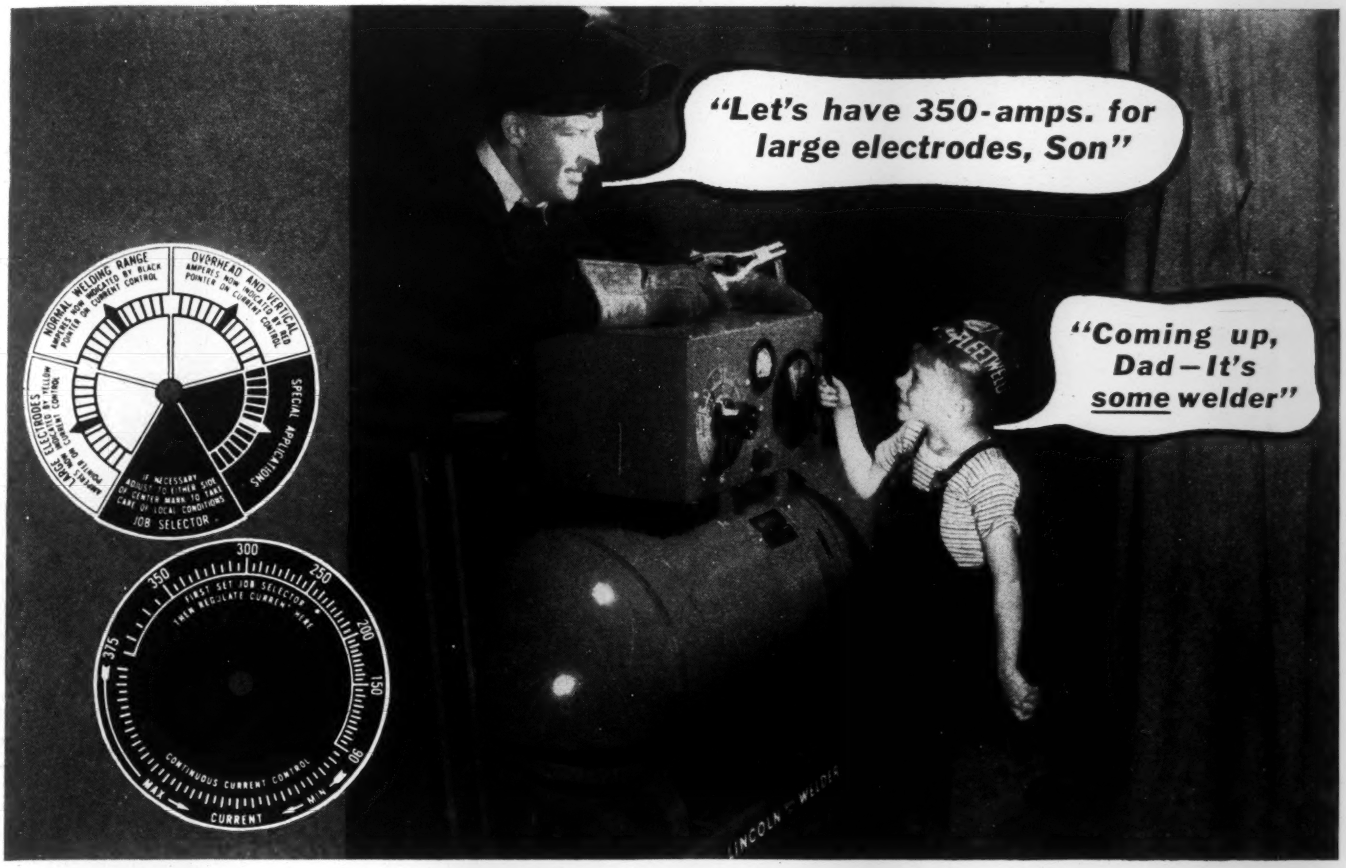
When the new central station heating plant was built, recently, Johnson Duo-Stats were installed as "master controllers" for almost every building on the campus. Twenty-seven of these unique instruments, operating to maintain the proper relationship between outdoor and heating system temperatures, insure steam economy and heating plant efficiency . . . The College of Engineering is responsible for the engineering work at the University of Kentucky.

Special devices are at work in the Tobacco Research Laboratory . . . Regardless of the problems encountered in automatic temperature and humidity control . . . heating, cooling, ventilating, air conditioning, special processing . . . Johnson engineers are prepared to supply the correct answer.

AUTOMATIC TEMPERATURE AND HUMIDITY CONTROL FOR HEATING, COOLING, VENTILATING, AIR CONDITIONING AND INDUSTRIAL PROCESSE

JOHNSON SERVICE COMPANY

MILWAUKEE, WIS., AND DIRECT BRANCH OFFICES IN PRINCIPAL CITIES


"Let's have 350-amps. for large electrodes, Son"
"Coming up, Dad—It's some welder"
FLEETWELD
NORMAL WELDING RANGE AMPERES NOW INDICATED BY BLACK POINTER ON CURRENT CONTROL
OVERHEAD AND VERTICAL AMPERES NOW INDICATED BY RED POINTER ON CURRENT CONTROL
SPECIAL APPLICATIONS
LARGE ELECTRODES AMPERES NOW INDICATED BY YELLOW POINTER ON CURRENT CONTROL
IF NECESSARY ADJUST TO EITHER SIDE OF CENTER MARK TO TAKE CARE OF LOCAL CONDITIONS
JOB SELECTOR
300
250
200
150
90
350
375
FIRST SET JOB SELECTOR THEN REGULATE CURRENT HERE
CONTINUOUS CURRENT CONTROL
MAX
CURRENT
MIN
LINCOLN WELDER

Self-Indicating control of the new "Shield-Arc" assures highest quality welds at lowest cost . . . on every job

● Easy? Take it from this 7-year-old "helper." He says, "Of course I can't weld . . . that takes training and experience . . . but I can set this new Lincoln. Everything is right on the dials."

Self-Indicating Job Selector and *Self-Indicating* Current Control . . . both continuous in operation . . . make it possible to set the new *"Shield-Arc"* for the right TYPE and SIZE of welding arc easily, quickly and positively. This assures maximum quality and maximum speed for every welding job, every time.

This new Lincoln Welder gives you these additional benefits:

WIDE RANGE. For all types of work and exceptionally wide range of welding current. *Dual Continuous Control* provides literally thousands of combinations of voltage and current.

FASTER WELDING. Larger electrodes can be used because the welder is *Self-Protected against burnout.*

MINIMIZED SPATTER. *Independent Excitation* contributes to this money saving feature.

STEADY ARC. Under all welding conditions. *Laminated Magnetic Circuit* contributes to the welder's remarkable arc stability.

. . . and 25 other cost-cutting features. Consult the nearest Lincoln office or mail the coupon.

THE NEW LINCOLN SHIELD-ARC
THE NEW ARC WELDING TECH

THE LINCOLN ELECTRIC CO., Dept. RR-553, Cleveland, O.

☐ Have a Lincoln man call to explain the new Self-Indicating *"Shield-Arc."* ☐ Send free bulletin 412-A.

Name ____________ Position ____________

Company ____________

Address ____________

City ____________ State ____________

LINCOLN

LARGEST MANUFACTURERS OF ARC
WELDING EQUIPMENT IN THE WORLD

NO OTHER V-BELT COMPARES WITH DAYTON FOR

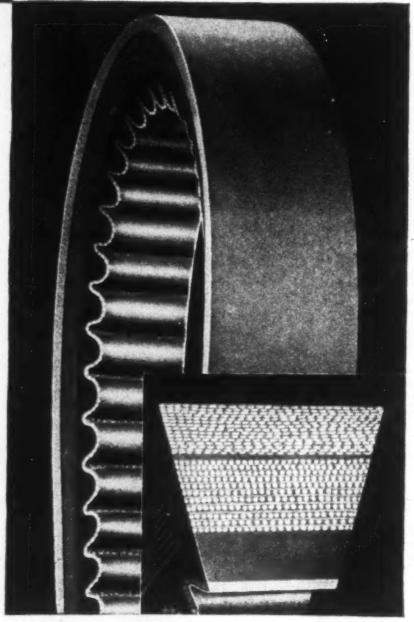
LONG LIFE

Unrivaled stamina . . . defiant toughness . . . outlasting ruggedness . . . these are the qualities which give the Dayton Cog-Belt its matchless endurance. No other V-Belt approaches it in vitality and persistent long life.

And the Dayton's patented, laminated construction saves it from the strains and stresses which shorten the lives of other belts. It bends easily without resistance and distortion. It rides straight and true in the pulley grooves . . . without squashing, twisting and whipping. It runs cool because its smooth-flowing action prevents the chafing and friction which create destructive internal heat.

From the very nature of its exclusive features and distinctive performance, the Dayton Cog-Belt gives phenomenally long service. That's why long life Dayton Cog-Belt Drives often cut belt replacements in half.

Equip with Daytons and forget your transmission troubles. Write us for catalogs and data, or call your local Dayton distributor.



THE DAYTON RUBBER MFG. CO.
DAYTON, OHIO

Dayton

COG-BELT DRIVES

MADE BY THE WORLD'S LARGEST MANUFACTURER OF V-BELTS

Here's the Filter You've Been Waiting For... Permanent, Washable ...and LOW-PRICED, too!

The New A/C 2 Permanent Washable Filter

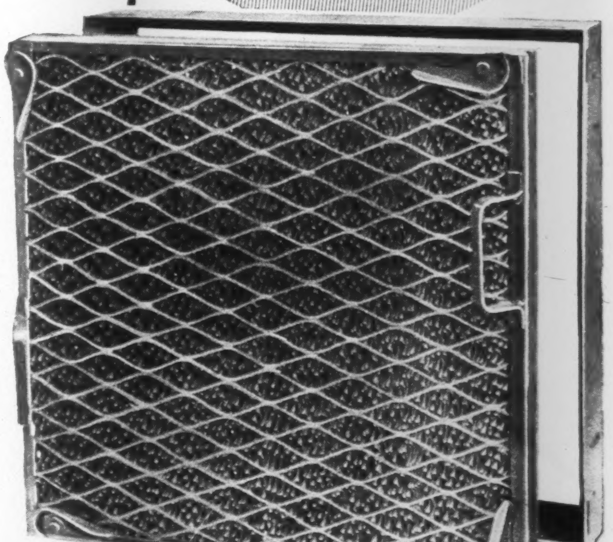
was developed especially for air conditioning service where washable filters are desirable and requirements are not abnormally severe.

Investigate its Possibilities

Warm air heating and air conditioning engineers are quick to recognize the economy and superior advantages of permanent type filters because they know that the price of clean air is the combined initial filter cost *plus* the expense of maintenance.

The new A/C-2 meets every filter requirement and can be cleaned at a cost of less than five cents for Viscosine. Compare this figure with the unit cost of one dollar or more for filters of the renewable type, and the economy of the A/C-2 is apparent.

Write for Bulletin 117-E for complete data on the new A/C-2 Filter.



AMERICAN AIR FILTER CO., Inc.
Incorporated
118 Central Ave., Louisville, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

AMERICAN AIR FILTERS

6 900
STEEL
6
250
S
400
OWG

at
BOOTH No. 71
POWER SHOW

up-to-the-minute-VALVES!

● The Reading-Pratt & Cady line of valves is of broad scope. It includes iron, brass and steel valves in sizes from 1/8″ to 48″. Pressure ratings range from 125 lbs. to 1500 lbs.

You will find typical and up-to-the-minute types on display in Booth No. 71 at the National Exposition of Power and Mechanical Engineering.

READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE COMPANY, INC.
BRIDGEPORT, CONNECTICUT

BUY ACCO QUALITY
TRADE MARK

A FEW OF THE 137 AMERICAN CHAIN & CABLE INDUSTRIAL PRODUCTS

AMERICAN CHAIN DIVISION
(DOMINION CHAIN COMPANY, Ltd., in Canada)
Weed Tire Chains • Welded and Weldless Chain • Malleable Castings
Acco-Morrow Lubricators

AMERICAN CABLE DIVISION
Tru-Lay Preformed Wire Rope • Tru-Loc Processed Fittings • Crescent Brand Wire Rope
Tru-Stop Brakes • Tru-Level Oil Controllers

ANDREW C. CAMPBELL DIVISION
Abrasive Cutting Machines • Floformers
Special Machinery • Nibbling Machines

FORD CHAIN BLOCK DIVISION
Chain Hoists • Trolleys

HAZARD WIRE ROPE DIVISION
Lay-Set Preformed Wire Rope • "Korōdless" Wire Rope • Preformed Spring-Lay Wire Rope • Guard Rail Cable

HIGHLAND IRON & STEEL DIVISION
Wrought Iron Bars and Shapes

MANLEY MANUFACTURING DIVISION
Automotive Service Station Equipment

OWEN SILENT SPRING COMPANY, Inc.
Owen Cushion and Mattress Spring Centers

PAGE STEEL AND WIRE DIVISION
Page Fence • Wire and Rod Products
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READING-PRATT & CADY DIVISION
Valves • Electric Steel Fittings

READING STEEL CASTING DIVISION
Electric Steel Castings, Rough or Machined
Railroad Specialties

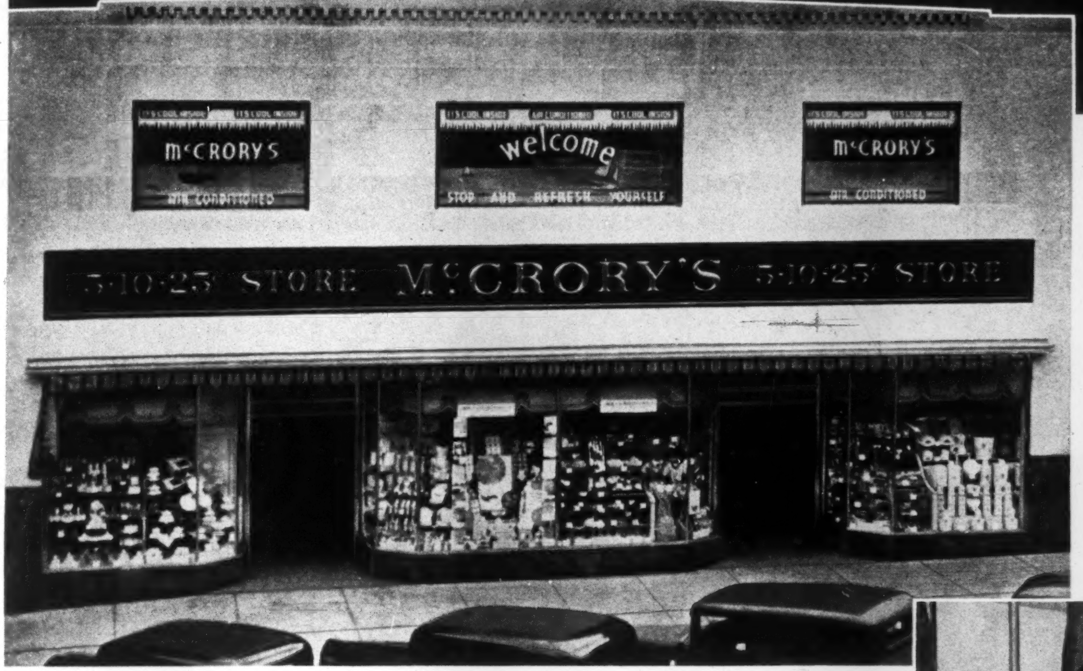
WRIGHT MANUFACTURING DIVISION
Chain Hoists • Electric Hoists and Cranes

In Business for Your Safety

READING·PRATT & CADY VALVES

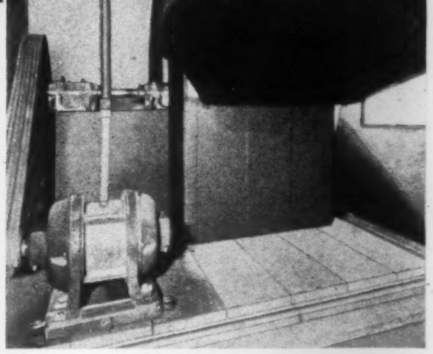
"IT'S COOL INSIDE!"

Means good business for McCrory's



● **This New McCrory Store** *in Danbury, Connecticut, is air conditioned throughout for better business. Armstrong's Corkboard Insulation was used to guard low temperatures for greater operating efficiency.*

● **Close-Up View** *showing how Armstrong's Corkboard insulates the ducts in McCrory's Danbury store. Made in boards, 12" x 36" up to 36" x 36", and in various thicknesses, this insulation is quickly and easily installed.*



Armstrong's Corkboard aids air conditioning efficiency

STORES rely on air conditioning to help keep up traffic during hot summer months. And engineers rely on Armstrong's Insulation to help handle efficiently the lower temperatures that result. This pure cork insulation conserves refrigeration and reduces operating costs.

When you plan all year conditioning or summer cooling use Armstrong's Corkboard Insulation on cold air ducts, and on walls and roofs to avoid condensation. Cold lines are efficiently guarded with Armstrong's Cork Covering. And under vibrating machinery, Armstrong's Vibracork quiets the noise and absorbs the shocks that cause annoyance and even damage.

The unique natural cell structure of cork is your assurance of longer life and greater efficiency. Each pure cork granule, used in making Armstrong's Corkboard and Cork Covering, is composed of thousands of tiny, still-air cells, hermetically sealed from one another. These cells present an effective barrier to the passage of heat. What's more, they resist the moisture that is always met in working with low temperatures. That's why Armstrong's Cork Insulation lasts so long in all types of service.

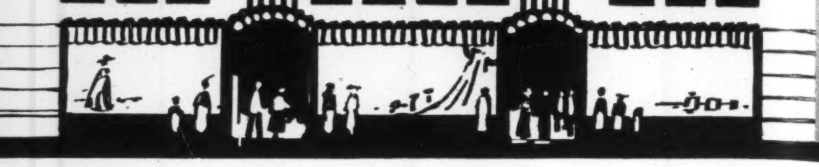
You can profit from years of engineering experience by calling on Armstrong's Contract Service to plan and install insulation.

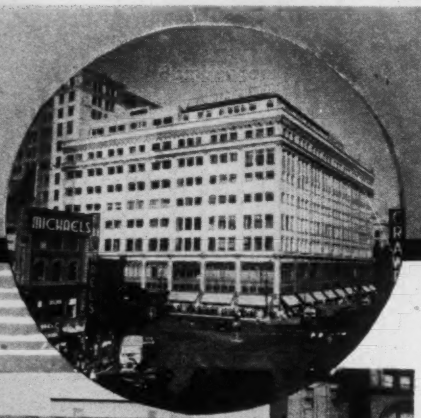
The next time you plan an air conditioning installation, whether for remodeling or new construction, let your figures include efficient Armstrong's Cork Insulation. Meanwhile, write today for complete file data. Address Armstrong Cork Company, Building Materials Div., 994 Concord St., Lancaster, Pa.

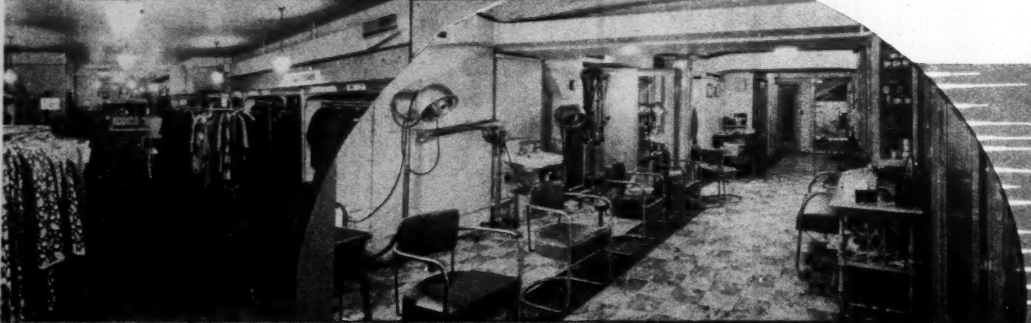
Armstrong's CORK INSULATION

CORKBOARD **CORK COVERING** **VIBRACORK**

AIR CONDITIONED
SHOPPING







WHO PAYS FOR AIR CONDITIONING IN STORES?

Neither price concessions, large ads nor deluxe window displays will keep your sales volume up in the hot months. Air conditioning alone succeeds where all other methods fail. It not only increases the number of customers—it increases the average sale as well!

Air conditioning costs money—yes, but *who pays for it?* Next summer it will be the store that doesn't have it; for the best part of the trade will shop in comfort in the next block, the next district or *the next town,* if necessary. The business you want most will gravitate to the stores that are cool!

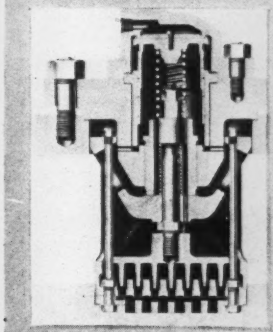
Who Pays the Least for Store Air Conditioning?

The store that installs air conditioning with the best independent engineering advice available in the vicinity. The store that installs equipment which will give satisfactory results in the twilight temperature zones of spring and fall and lowest operating and maintenance costs in the long run.

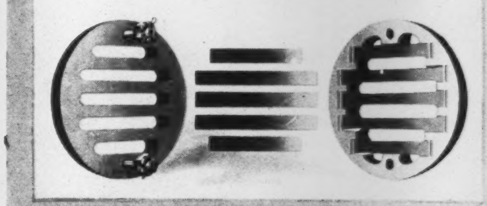
That, in brief, is a description of the results *you* can count on when your engineer specifies Worthington-Carbondale air conditioning equipment.

GOOD AIR CONDITIONING
•
ATTRACTS TRAD
•
IMPROVES SERVIC
•
PROTECTS GOOD

WORTHINGTON
CARBONDALE



Unloading element for capacity control—an exclusive Worthington feature.



FEATHER valve

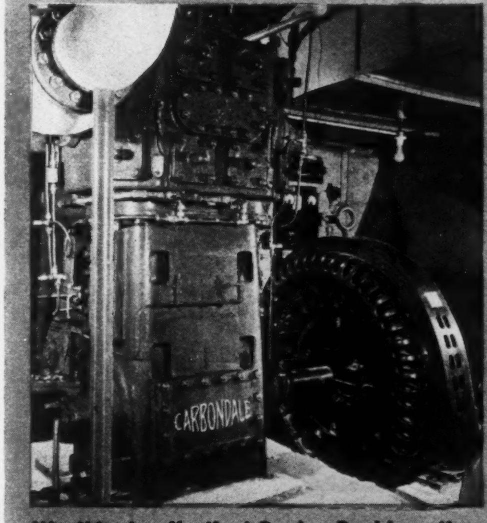
OU DON'T HAVE TO BE AN ENGINEER

to appreciate the reasons why Worthington-Carbondale equipment will serve you efficiently and satisfactorily for years to come. Here are some of the reasons:

EFFICIENCY—There never was a more efficient cooling device than the reciprocating compressor, a type of equipment pioneered by Worthington since the early days of refrigeration as well as air conditioning.

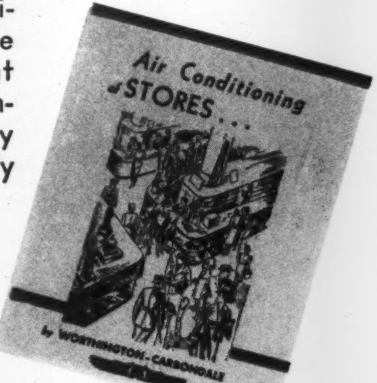
CONTROL—The Worthington Feather Valve is an exclusive feature not obtainable in any other make of compressor. It "breathes" by flexing, and is quiet and highly efficient. It is ideal for dense gases such as "Freon-12" and permits a perfection of control that keeps cooling always in step with temperatures and humidity, eliminating the well known difficulties presented by the light loads of the spring and fall.

UNIT RESPONSIBILITY—Worthington manufactures every element, from compressors and evaporators to pumps and V-Belts, in all types and sizes. The reliability, efficiency and long life of Worthington equipment have been repeatedly demonstrated. That's why so many independent engineers specify Worthington.



Worthington Vertical Duplex Double-acting Compressor for large tonnage installations.

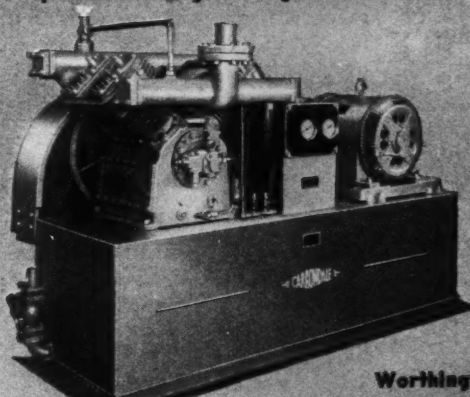
OD EQUIPMENT
IS QUIET
•
EFFECTIVE
•
INEXPENSIVE
•
THE LONG RUN



Worthington-Carbondale catalogs on all types of cooling and air conditioning equipment, including air conditioning units and shower condensers, are available.

Ask for Booklet
No. 1150

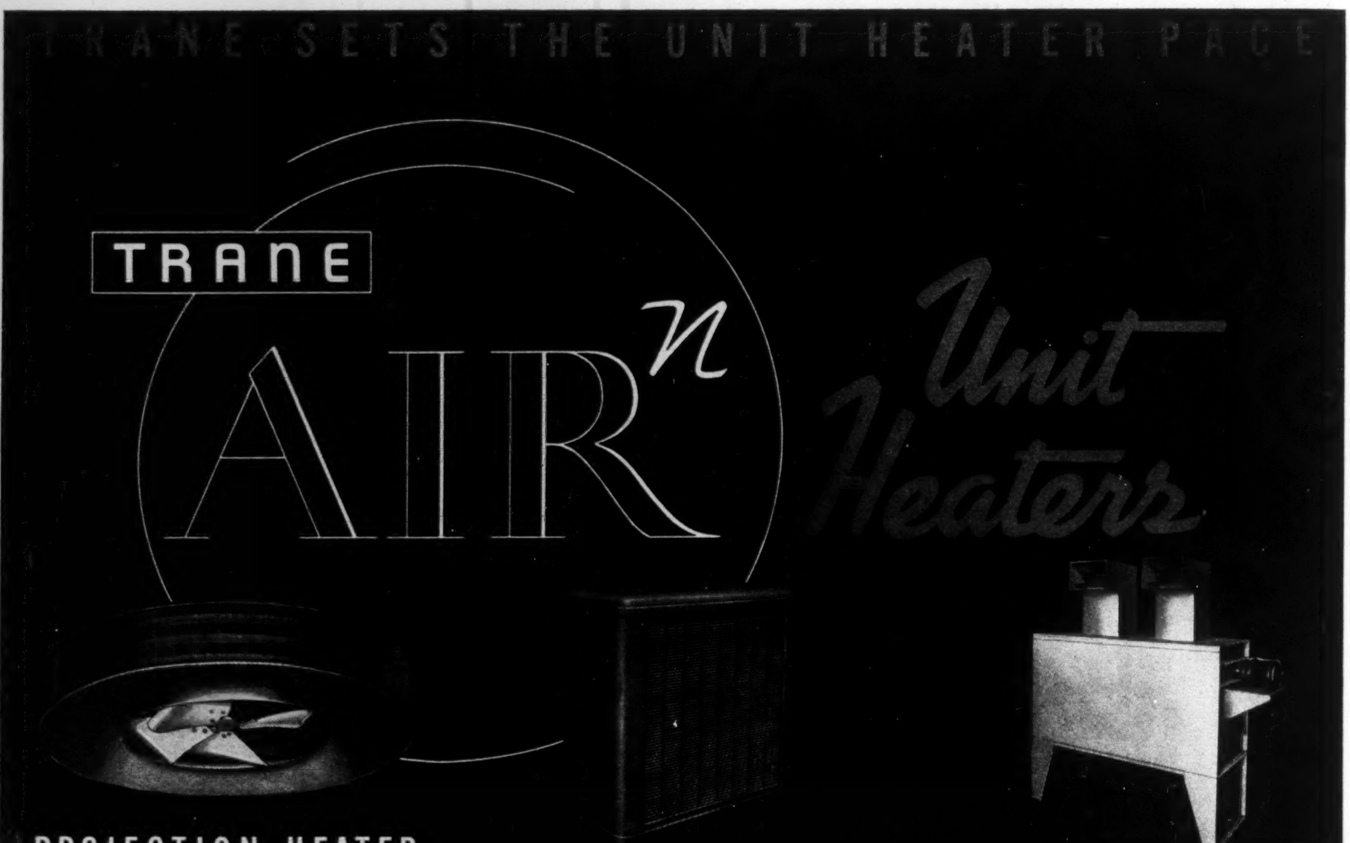
CA8-31



Worthingt
Condensing Uni
for service up to 125 H.

WORTHINGTON PUMP AND MACHINERY CORPORATION
CARBONDALE DIVISION • HARRISON, NEW JERSEY
Air Conditioning and Refrigeration Representatives in Principal Cities
AIR CONDITIONING EQUIPMENT
ELECTRIC • STEAM • DIESEL OR GAS DRIVEN

WORTHINGTON



PROJECTION HEATER
Salvages Ceiling Heat

STANDARD PROPELLER TYPE
Quiet, efficient Spot Heating

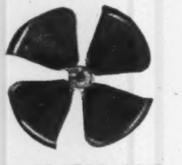
TORRIDOR—BLOWER TYPE
Either belt or direct driven

Trane engineering knowledge, in collaboration with Architects, Engineers and Contractors, enables us to offer the greatest line of Unit Heaters.

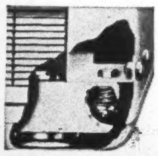
Trane manufactures a limitless variety of sizes and styles to meet your every requirement. Old-fashioned cast iron pipe coils and radiators—yes, and even ordinary unit heaters have passed out of the picture. Trane Unit Heaters, with their many advantages, are constantly broadening the field of unit heater application. Not only factories, and garages, but shops, offices, lunch rooms, dance halls as well. Any space is a prospect for some type of Trane unit heater. Only a line like the great Trane line can provide the exact type.

There are huge Trane Torridor Blower Type Units for the delivery of large quantities of heated air. There are Model "N" Propeller Type Unit Heaters which have solved heat problems in factories and commercial establishments the country over . . . And, in the amazing Projection Unit Heater there is the most advanced development in years and years—for loss of heat, at ceilings, is now licked, and what was formerly wasted heat is put to work down at the floor level where it belongs.

The scope of installations of Trane Unit Heating Equipment is interesting information for every Engineer and Contractor. We urge you to write and ask for Unit Heater Bulletin No. S-327. In it you will find an answer for new building or remodeling requirements.

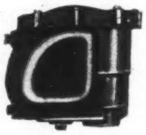


FAN
New 4 Blade Fan. Balanced and formed to eliminate noise due to air friction.



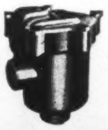
CRADLE COIL
(Cut-Away Section)
Showing how coil is spring cradled in casing. Eliminates all stress and strain due to expansion.

Because of the exclusive Trane feature known as "Balanced Pressure" Trane Traps will withstand extremely severe operating conditions. A rupture due to pressure differences is a physical impossibility with Trane Traps.

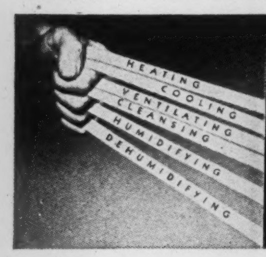


FLOAT TRAP
Equipped with the famous Trane balanced pressure thermostatic bellows that locks against steam and lasts indefinitely.

FLOAT VENT
Extra large air capacity through ¼-inch port. Float seals against water leakage. Bellows closes port against steam leakage.



BUCKET TRAP
Designed for use with Blast Coils, Unit Heaters or at low points on high pressure steam lines to clear condensation and discharge air.



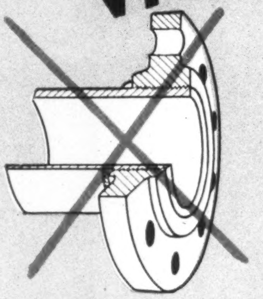
TRANE

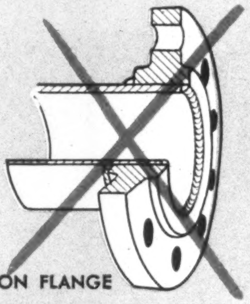
THE TRANE COMPANY AIR^n **LA CROSSE, WISCONSIN**

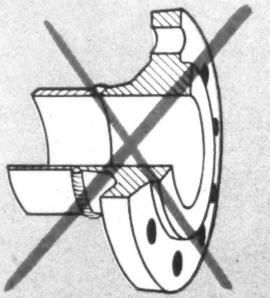
Also TRANE COMPANY OF CANADA LTD., TORONTO, ONTARIO

Unit Heaters · Specialties · Convectors · Climate Changers · Cooling Coils · Unit Coolers · Blast Coils · Unit Ventilators

MIDWEST VAN STONE WELDING NIPPLE makes the *ideal* flanged joint for welded piping systems


SCREWED AND WELDED FLANGE


SLIP-ON FLANGE
WELDED FRONT AND BACK


WELDING NECK FLANGE

For making connections to boilers, pumps, valves and other flanged outlets (and where piping must be frequently cleaned or inspected for corrosion), Midwest Van Stone Welding Nipples have a tremendous advantage over flanges that are welded to the pipe (see drawings at left). The swivel flange of the Nipple makes it unnecessary to accurately line up the bolt holes before welding; "setting up" is simple and quick because no special clamps or jigs are required to hold the face of the flange absolutely perpendicular to the axis of the pipe. The result is a real saving in time and cost of welding.

Another important economy is in erection. Field organizations report a saving of 25% in erection time for making up a joint using Midwest Van Stone Welding Nipple in comparison with flanges rigidly fixed to the pipe; this saving is even greater when the flanges are on bends.

Ask for Bulletin WF-36 which gives complete data regarding Midwest Van Stone Welding Nipples . . . and other Midwest Welding Fittings that simplify and save on welded piping.

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS

MIDWEST
PIPING & SUPPLY COMPANY, Inc.
Main Office: 1450 So. Second St., St. Louis, Mo.

Plants: St. Louis, Passaic (N. J.) and Los Angeles • Sales Offices: Chicago—946 Marquette Bldg. • Houston—1716 Second National Bank Bldg. • Los Angeles—520 Anderson St. • New York—(Eastern Division) 30 Church St. Tulsa—533 Mayo Bldg.

Prevent Heat Waste
Assure Uniform Warmth — Save Money
with Sturtevant Rexvane Heaters

The CEILING is 31½ FT. HIGH
Sturtevant

Stock and shipping room of large Eastern Manufacturer, heated by eight Sturtevant Rexvane Heaters. Total B. T. U. — 6,800,000, with 60° entering air; 10 lbs. steam pressure. Total C. F. M. — 95,680.

THIS TOUGH HEATING JOB SHOWS HOW IT'S DONE

THIS LARGE AREA is the shipping and stock room of a well-known Eastern Manufacturer. It is 460 ft. long and 60 ft. wide — with a ceiling 31½ ft. high!

Eight Sturtevant Rexvane Heaters take care of the entire heating job. Yet, despite the size of the area and great height of the ceiling, the temperature is kept uniformly warm over the entire space at floor line.

No valuable floor space taken up—all units hung overhead, at the walls.

If you have a heating problem, let us show you, too, how you can prevent heat waste, assure uniform warmth and save money with Sturtevant Rexvane Heaters. Our nearest representative will gladly call or mail Catalog 395-3.

B. F. STURTEVANT COMPANY Hyde Park, BOSTON, MASS.
Sales Offices in 40 Cities B. F. Sturtevant Co. of Canada, Ltd.—Galt, Toronto, Montreal

Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

Rexvane Heater Advantages

1. **Guaranteed for 200 lbs. Pressure** And suitable for all steam pressures up to 200 pounds.
2. **Low Final Temperatures** Assure comfort for people near heaters.
3. **Guaranteed Capacities** In accordance with A. S. H. V. E. requirements.
4. **Wide Range of Sizes** Up to 1,421,000 B.T.U. (Standard rating).
5. **Flexibility of Application** All sizes available for either floor, wall or ceiling installation — belt or direct drive.
6. **High Efficiency** Large air volume handled with comparative quietness — at high efficiency — and extremely low horse-power.
7. **Time-Saving Installation** Sectional construction permits reversal of fan, heating, and center units to meet unexpected piping or other conditions on job.
8. **Thermadjust Control** Optional; either automatic or manual operation.
9. **Three-Bearing Construction** Assures long shaft life. Center bearing easily re-aligned on job by any mechanic.

Fans, Blowers, Air Washers, Air Conditioning, Heating, Vacuum Cleaning, Drying, Mechanical Draft Equipment

YOUR WORK

Deserves this Lasting Metal

INGOT IRON
ARMCO
INGOT IRON

• The quality of sheet metal is important in air conditioning. Corrosion from condensation and other sources can be the cause of much trouble and expense. To be sure of long trouble-free service, use or specify galvanized ARMCO Ingot Iron for all ducts and other sheet metal work.

This durable metal has the longest established record of actual service of any low cost iron or steel sheets. Its extra refinement assures years of thrifty service. Then, too, extensive advertising has made people familiar with the name ARMCO Ingot Iron and they accept it readily. Sheet metal men like it because it is ductile and forms readily into neat, attractive jobs.

Protect your specifications and gain satisfied customers by specifying galvanized ARMCO Ingot Iron . . . or Armco Galvanized PAINTGRIP sheets for work that must be painted after installation. Quick deliveries can be made by any Armco distributor. The American Rolling Mill Company, Executive Offices: 1701 Curtis St., Middletown, O.

ARMCO

ARMCO

INGOT IRON

Higher standards, LOWER COSTS with TUBE-TURNS and Welding!

Any welder knows that he can do a far better job, in far less time, when his fittings "line up" with the pipe. This isn't a mere *theoretical* advantage of Tube-Turns—it's a fact that you can prove with stop-watch and testing coupon. . . If you'll inspect any Tube-Turn that has been cut away to show its uniform wall-thickness and its true round cross-section, we believe you, too, will join the *majority* of piping experts who "insist on Tube-Turns". . . Tube-Turns, Incorporated, Louisville, Ky.

The word "Tube-Turn" is NOT a necessary general trade name for welding fittings. It is the registered trade-mark for the products made by Tube-Turns, Incorporated, under their patents.

An Air Conditioned School..

WITH A COMPLETE

MINNEAPOLIS-HONEYWELL

PNEUMATIC CONTROL SYSTEM

THE first unit of the new Municipal University of Omaha is one of America's first air conditioned schools. In every respect, this new building represents the last word in school design and construction. It is, therefore, significant that both the winter heating cycle and the summer cooling cycle are completely controlled by a Minneapolis-Honeywell Pneumatic Control System. Each Minneapolis-Honeywell Control System is engineered for its individual installation. Only Minneapolis-Honeywell offers a complete line of controls—Pneumatic, Electric or a combination of both. M-H Engineers can therefore give you unbiased advice in the selection of a control system for your school building. Minneapolis-Honeywell Regulator Co., 2701 Fourth Avenue South, Minneapolis, Minnesota. Branches everywhere.

The First Unit of the New Municipal University of Omaha . . . Architects: John Latenser & Sons, Inc., Omaha, Nebraska

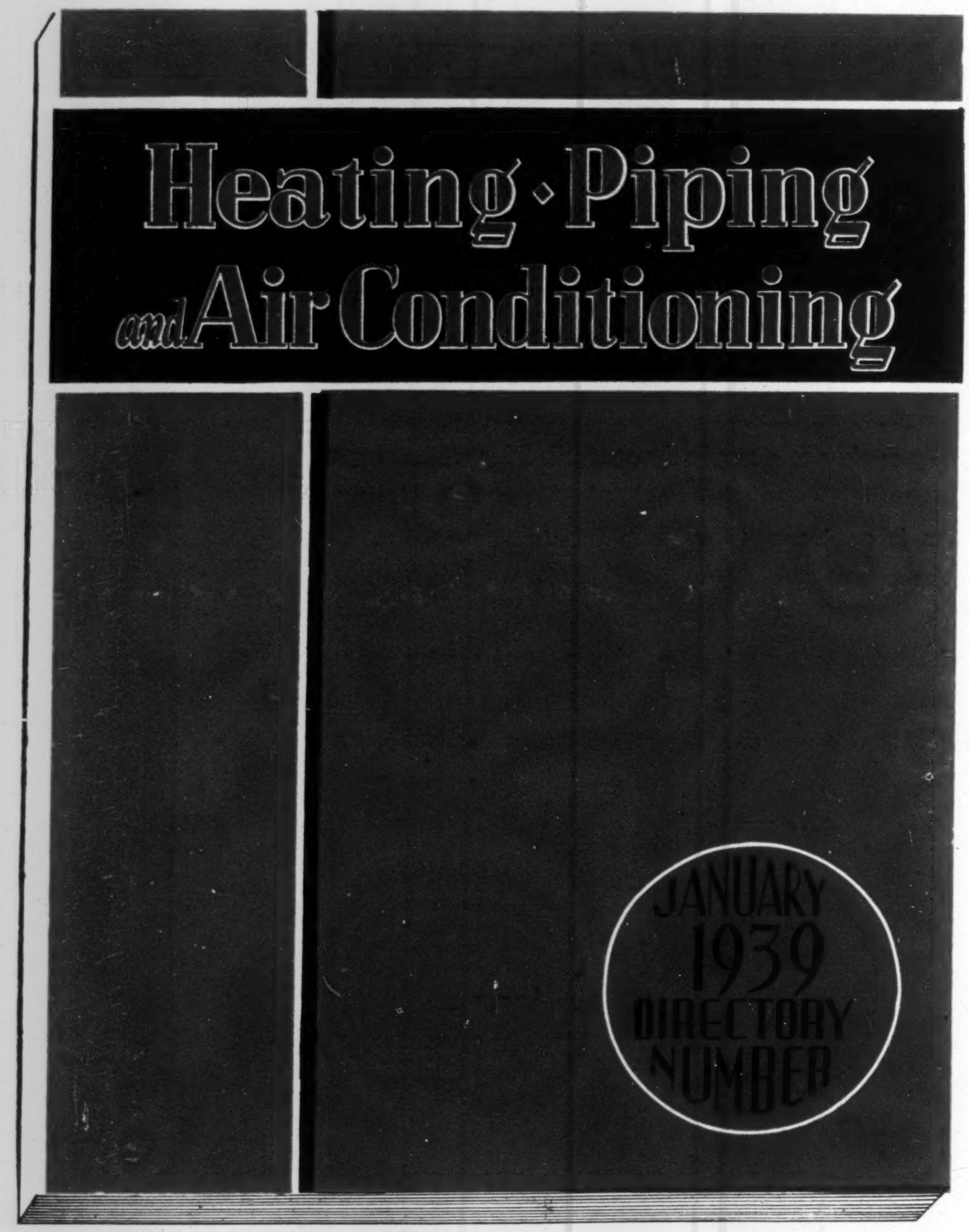
MINNEAPOLIS-HONEYWELL

BROWN INDUSTRIAL INSTRUMENTS
NATIONAL PNEUMATIC CONTROLS

Control Systems

AUTOMATIC CONTROLS MH

NEXT ISSUE



Manufacturers

The January Directory issue of HEATIN PIPING & AIR CONDITIONING present golden opportunity to get your message b fore the key engineers and contractors this field at little cost. This Directory, t fifth, will be read and preserved, like oth issues, for its valuable technical articles an data and will be referred to time after tim throughout the year for the complete buyin information contained in its accurate an up-to-date directory listings.

Space in this issue costs no more than an other issue and packs a wallop that can no only start you off to a successful year, bu background your selling throughout all 1939. Write us now for rates and furth information.

● *Closing Date*

We request that copy for this issue be forwarded us as far in advance as possible. Color, cover a insert forms close December 10th. . . . Black a white forms close December 20th. By getting yo copy to us early, you'll help us to put it throu without to much rush, and assure yourself of a vance proofs and favorable position.

send us your reservatio

...TODAY

Heating-Piping and Air Conditionin

6 North Michigan Avenue *Chicago, Illin*

IT . .

The January 1939 Annual Directory Number!

THE DIRECTORY SECTION

1 PRODUCTS CLASSIFIED

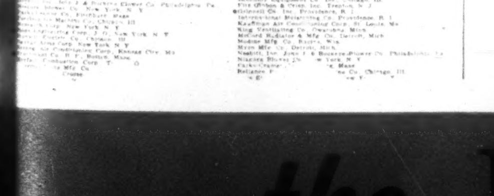
In this section every product and accessory used in industrial and commercial heating, piping and air conditioning work will be listed. Under each one will be the names of all manufacturers who make it. An engineer, a contractor or manufacturer who wants to know where he can buy or secure information on a certain product can turn to this section, find the product properly indexed and cross-indexed, see under it the names of manufacturers who make it.

2 TRADE NAMES

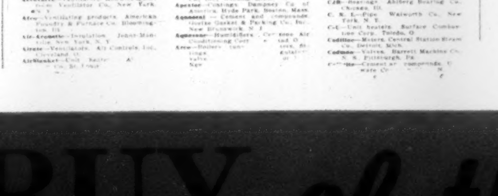
Here the buyer who knows of a product only by its trade name can find its maker by looking for that trade name in its proper alphabetical place. Every trade name of a product in this field is listed in this section, with the product it designates and the name of its manufacturer. No more bother trying to locate a manufacturer by uncertain means when you're in a rush. Just refer to this part of the Fifth Annual Directory and you'll get your information in jig time.

3 MANUFACTURERS' ADDRESSES

In this section all manufacturers will be listed with complete street address and city. Here the buyer finds where to direct his inquiry or his order and eliminates frequent delays caused by wrong addresses and mis-information. Just turn to this section, copy the manufacturer's address and save the usual time necessary to get it from less reliable sources.



DIRECTORY SECTION
HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS
PART 1—PRODUCTS CLASSIFIED



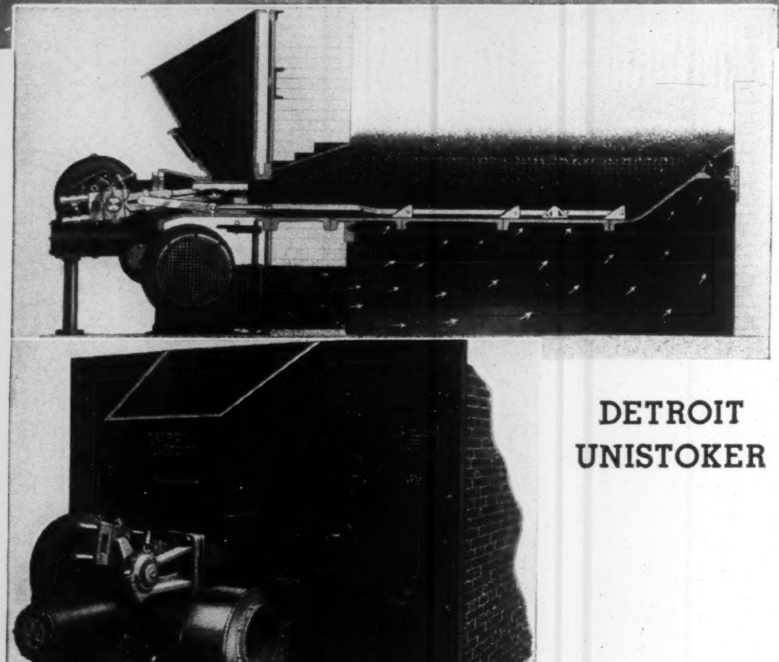
DIRECTORY SECTION
HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS
PART 2—TRADE NAMES

DIRECTORY SECTION
HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS
PART 3—MANUFACTURERS' ADDRESSES

. . the BUY of the Year!

The Vulcanized Rubber Co.,
Morrisville, Penna.

4 DETROIT STOKERS *Reduce* OPERATING COSTS $5000 PER YEAR


DETROIT UNISTOKER

● The Vulcanized Rubber Co., Morrisville, Penna., reports approximately $5,000 a year reduction in fuel and labor costs with four Detroit Stokers. The boilers were formerly hand fired with a mixture of nut and slack bituminous, and No. 4 buckwheat anthracite coal. Detroit Stokers now burn the same mixture of fuel. The load includes a heavy demand for process steam, power and heating.

Thousands of Detroit Stokers are in daily operation. Why not let them save for you?

Write for Bulletin 678

Detroit Unistoker is mechanically driven through machine cut worms and gears that run in oil. Requires little power for operation.

An active grate area of proper proportions with no moving grates in or near the fire. Fuel and air supply are automatically and closely controlled in proper proportions according to steam demands.

DETROIT STOKER COMPANY

Fifth Floor, General Motors Building, Detroit, Michigan • Works at Monroe, Michigan
District Offices in Principal Cities • Built in Canada at London, Ontario

FIBERGLAS*...

an amazing product that may cut costs in your business!

Now being made by a new company—OWENS-CORNING FIBERGLAS CORPORATION—formed by Owens-Illinois and Corning

FIBERGLAS*—*pure glass in new forms for new uses*—has been proved successful in many practical commercial applications.

IN INDUSTRIES like building, electrical and industrial insulation . . . refrigeration . . . air conditioning . . . it has brought about important product improvements or actual savings in cost.

These advantages will give you the reason why:

1. FIBERGLASS is inorganic.
2. It is not subject to attack by acids (except hydrofluoric acid) corrosive vapors or moisture.
3. In application, it is light in weight.
4. It is an outstanding insulator and it is both fireproof and heat resistant.

THE FIELD OF POSSIBLE APPLICATIONS for FIBERGLAS has hardly been tapped. For it is essentially a *new basic material* which—because of its superior qualities—has potential advantages for nearly *every* industry.

New Company Formed For Manufacture and Research

A new company, OWENS-CORNING FIBERGLAS CORPORATION, has been formed jointly by Owens-Illinois Glass Company and Corning Glass Works . . . to carry on the manufacture of FIBERGLAS for its proved-successful applications . . . and to extend still further its development and field of usefulness.

Find Out If FIBERGLAS Can Improve Your Product . . . Save You Money!

In your own business, FIBERGLAS may have an application that will improve your product or process . . . give you new economies in design and construction.

It has done so in other industries. And it may be that—for *your* industry—FIBERGLAS is *already* available in a form to fit your specific problems. An inquiry will bring to your desk complete information on FIBERGLAS and its present industrial applications.

*T. M. REG. U. S. PAT. OFF.

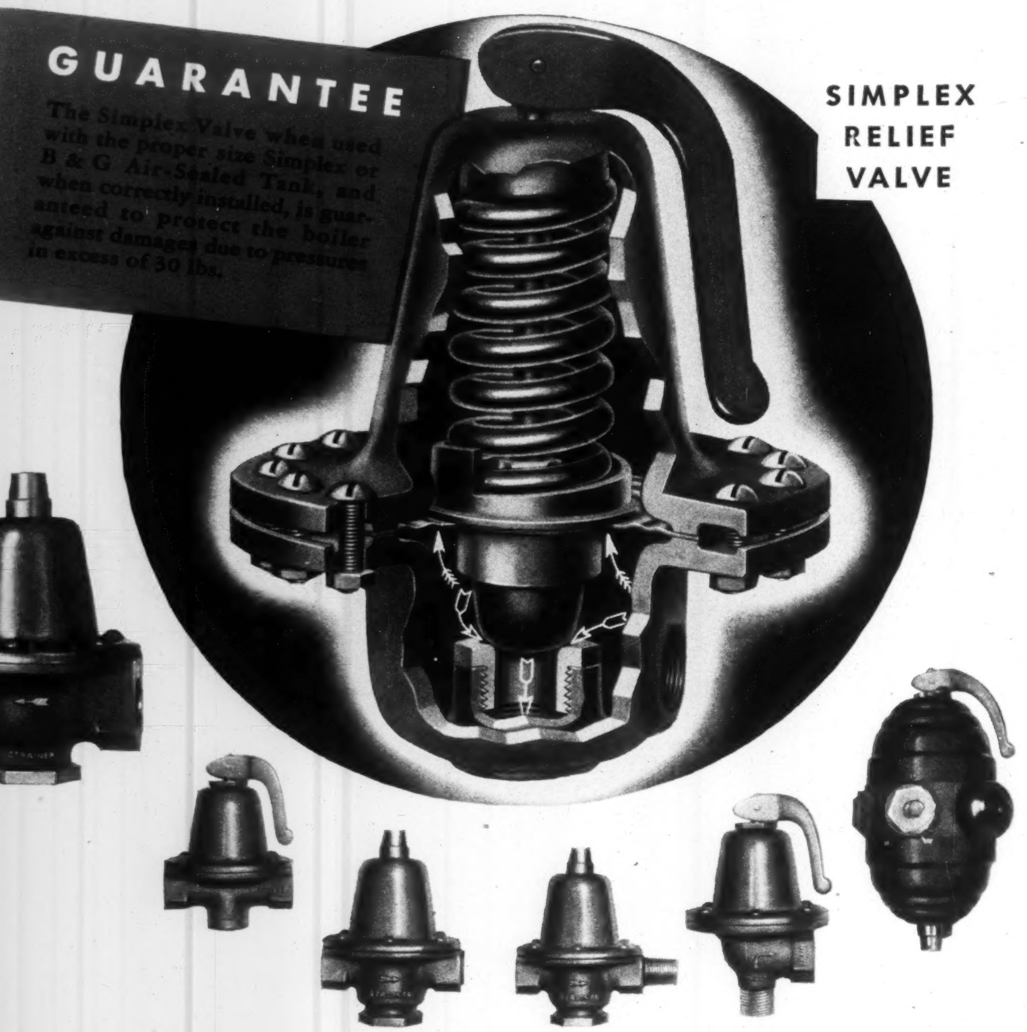
For information or consultation, write to

OWENS-CORNING FIBERGLAS CORPORATION
TOLEDO, OHIO

Factories in NEWARK, OHIO, AND CORNING, N. Y.
Sales offices in NEW YORK, BOSTON, WASHINGTON, CHICAGO, DETROIT, PITTSBURGH, CINCINNATI AND LOS ANGELES
RESEARCH LABORATORIES IN NEWARK, OHIO

COPYRIGHT, 1938 OWENS-CORNING FIBERGLAS CORP.

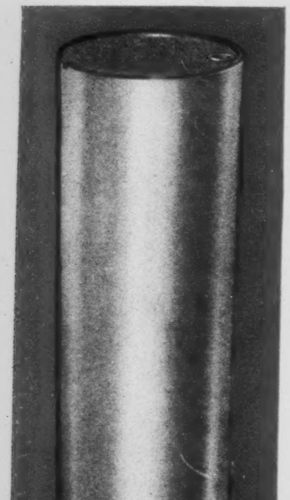
FOR GENUINE SAFETY



GUARANTEE

The Simplex Valve when used with the proper size Simplex or B & G Air-Sealed Tank, and when correctly installed, is guaranteed to protect the boiler against damages due to pressures in excess of 30 lbs.

SIMPLEX RELIEF VALVE



For boiler protection equipment, heating men are steadily turning to B & G Relief Valves and Air-Cushioned Tanks. We know this to be a fact because our sales records speak for themselves! B & G safety equipment has demonstrated its utter dependability!

Look at the Simplex Relief Valve if you want a good example. Packed with safety features! Its oversize diaphragm gives it giant lifting power. Its rust-proof bronze internal construction and absence of guides defy sticking caused by corrosion. And, as with all B & G Relief Valves, it is equipped with a try-handle, in accordance with the ASME Code.

Examine any B & G Relief or Reducing Valve and you'll find the same excellence of design, material and workmanship. On your next valve order, for safety's sake, say "B & G."

SIMPLEX TANK

Copper-bearing steel, welded to make it absolutely air-tight. Can be installed either on floor or ceiling.

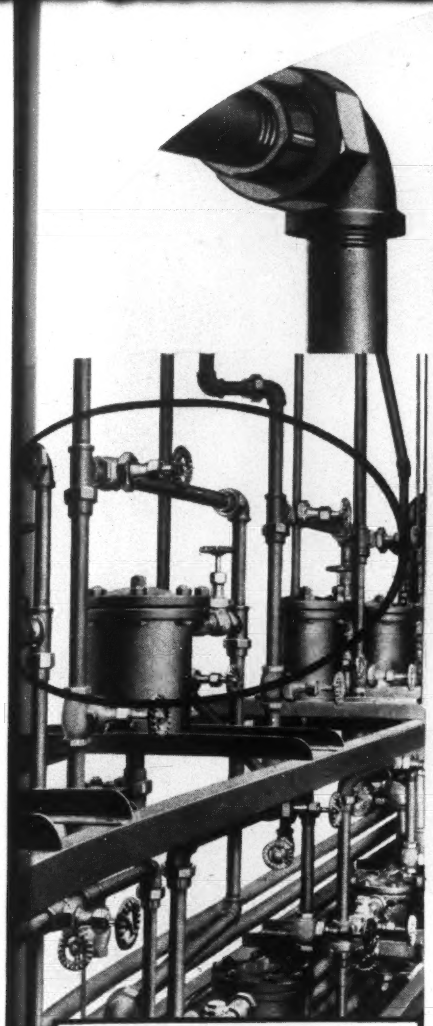
B&G

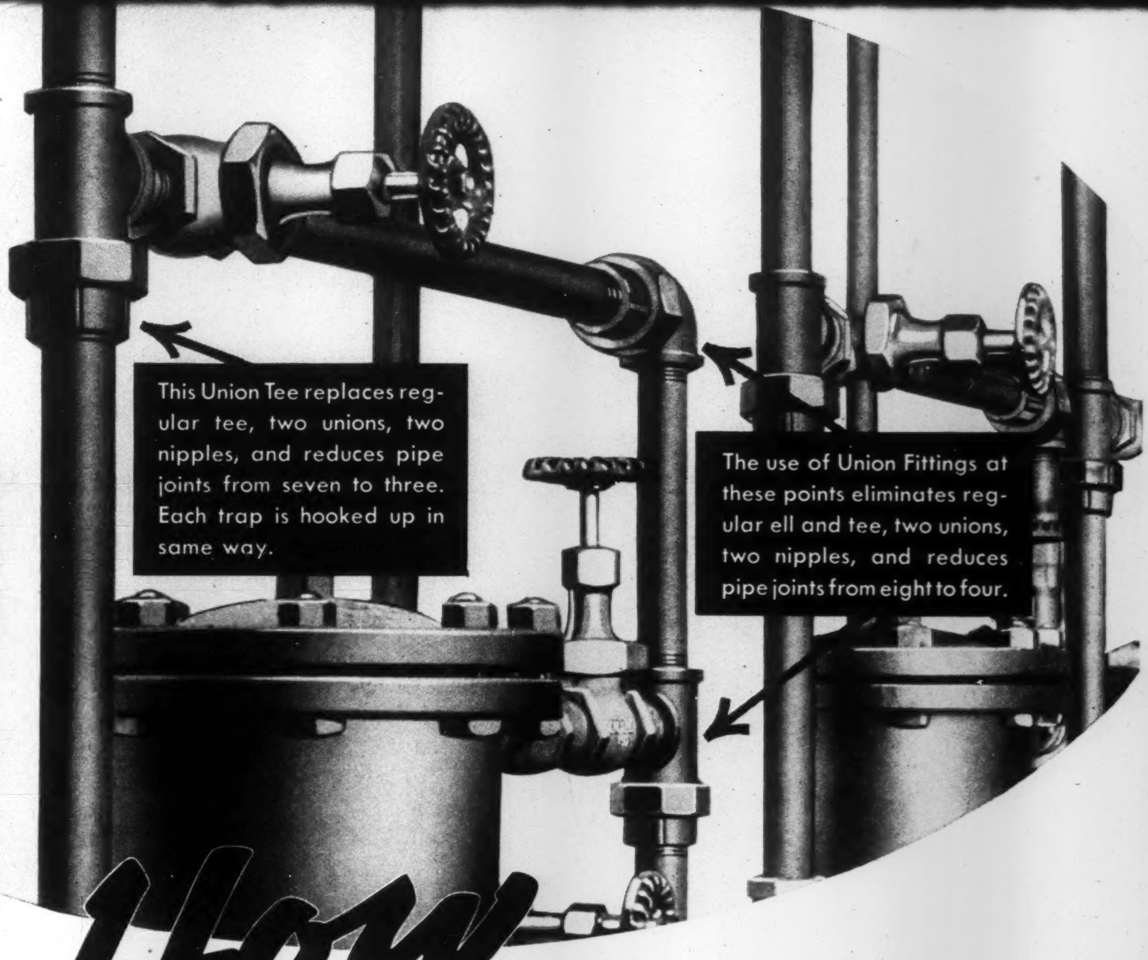
BELL & GOSSETT CO.

3000 WALLACE STREET, CHICAGO

BOOSTERS... MONOFLO SYSTEMS ... SERVICE WATER HEATING SYSTEMS... FLO-CONTROL VALVES... THERMO-VOIRS ... ELECTRICAL CONTROLS.

SEE YOUR REGULAR WHOLESALER





This Union Tee replaces regular tee, two unions, two nipples, and reduces pipe joints from seven to three. Each trap is hooked up in same way.

The use of Union Fittings at these points eliminates regular ell and tee, two unions, two nipples, and reduces pipe joints from eight to four.

How CRANE UNION FITTINGS SAVE MATERIAL, TIME AND LABOR

A comparison of piping materials and pipe joints required to hook up this bank of steam traps—

	—with Union Fittings		—with Regular Fittings	
	Quan.	Pipe Jts.	Quan.	Pipe Jts.
Ells	1	2	13	26
Union Ells	12	24		
Tees			11	33
Union Tees	10	30		
Unions			26	52
Nipples	16	32	43	86
TOTALS	39	88	93	197

$99\frac{9,996,551}{10,000,000}\%$

of Crane fittings are found fit. Details in folder sent upon request.

The use of union fittings in piping systems is often overlooked. They are valuable even in simple hookups, but in more elaborate layouts, their advantages are emphasized. Because a single union fitting ordinarily serves the same purpose as a tee or elbow, union and nipple, installation costs are minimized—in material, time and labor. Union fittings reduce the number of threaded joints—giving greater safety. Pipe lines gain a workmanlike makeup that adds to plant appearance.

Depend on Crane-Quality union fittings to help keep your liquid, air, and vapor lines at peak efficiency always. The amazing standard of perfection that Crane has attained in the manufacture of millions upon millions of fittings of every type yearly, is strong assurance of their unfailing, trustworthy performance. You'll find that Crane-Equipment throughout your plant brings greatest piping satisfaction, because—in fittings as in valves—

IT'S WHAT'S INSIDE THAT COUNTS!

CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

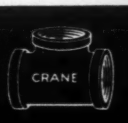
CRANE CO., GENERAL OFFICES: 836 SOUTH MICHIGAN AVENUE, CHICAGO, ILLINOIS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

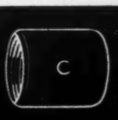
CRANE SCREWED FITTINGS FOR POWER PLANTS AND FACTORIES

Crane's line of fittings includes not merely the few hundred types and sizes in most common use, but a total of more than 10,000 separate and distinct items in cast and malleable iron.

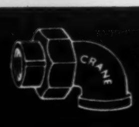
ELBOWS—90°, 67½°, 60°, 45°, 30°, 22½°, 11¼°, and 5⅝°, Street, Long Sweep, Side Outlet, Drop, Hub Vent



TEES—Service, Four-Way, Drop Tees, Long Sweep, Double Sweep, Wash Tray



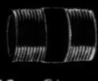
COUPLINGS—Right Hand, Right and Left, Half (Also Wrought Iron), Reducers, Increasers



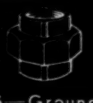
UNION FITTINGS—Male and Female, 90° and 45° Elbows, Tees with Union on Run or Outlet

BUSHINGS—Outside and Inside Hexagon, Face, Eccentric, Double Tapped

PLUGS—Square Head, Solid, Countersunk, Bar, Barrel



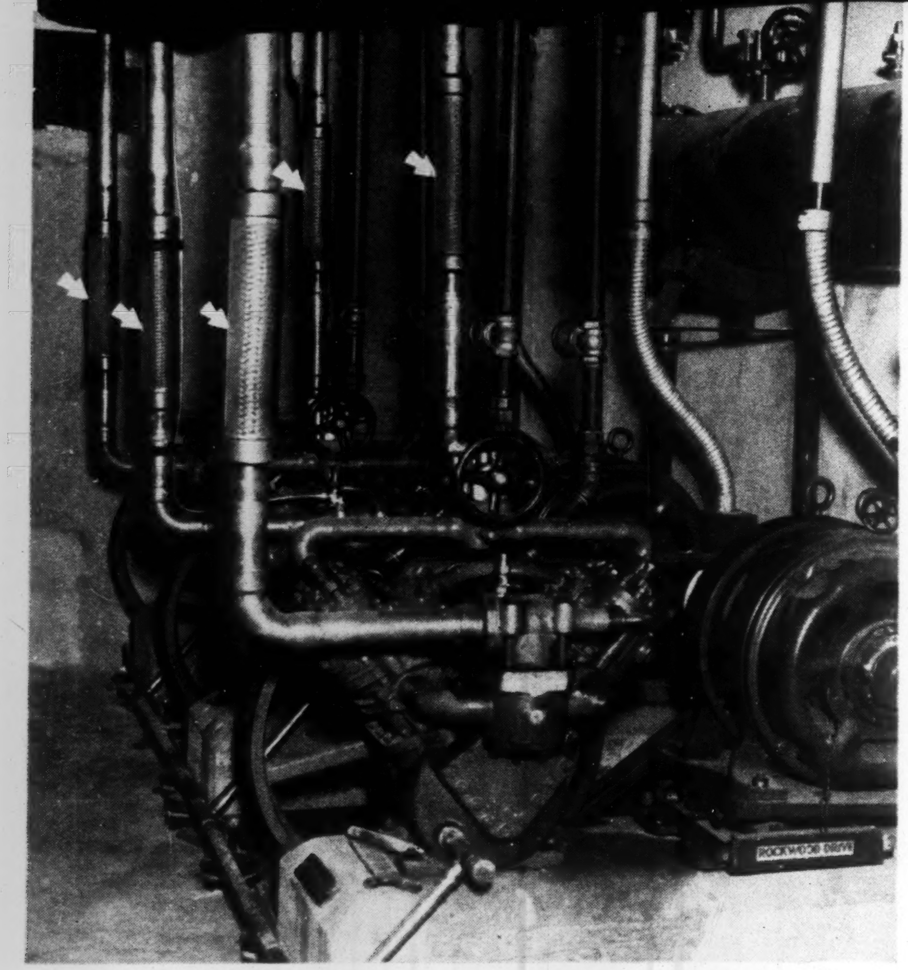
NIPPLES—Close, Short, Long, Tank



UNIONS—Ground Joint, Gasket Type, Female, Male and Female, Air-Pump

A CRANE FITTING FOR EVERY PURPOSE—The screwed fittings shown above are only a few of the scores of different types and modifications. The complete Crane line includes banded and plain patterns, black or galvanized, in a wide range of straight and reducing sizes; in four pressure classes in malleable iron and five in cast iron.

Conquer the Noise and Vibration Problem



Above: *Five American Vibration Eliminators in the suction lines of this commercial installation reduce noise and aid quiet operation. Installation in a Warner Bros. Theatre made by the Typhoon Air-Conditioning Co., Inc., N. Y. C.*

Below: *Cross section of an American Vibration Eliminator shows the corrugated seamless flexible tubing—copper tube ends are welded directly to the flexible section. Outer covering is high-strength bronze wire braid.*

ON your next installation of air-conditioning equipment, why not do as architects and consulting engineers all over the country are doing—specify AMERICAN VIBRATION ELIMINATORS for the liquid and suction lines . . . lick the noise and vibration problem right in the beginning.

Thousands of American Vibration Eliminators in service for years prove that their use is the one sure way to reduce compressor vibration to a minimum . . . to kill nuisance noise and prevent its transmission along pipe lines.

They are Seamless

Fabricated from *Seamless* Flexible Tubing of high tensile strength bronze, American Vibration Eliminators give dependable, long-life service. Here's why: True *Flexibility* prevents breaks and cracks due to constant compressor vibration; *Seamless* Flexible Tubing—manufactured without welds, laps or joints—prevents seepage and leaks; and Bronze resists the corrosive action of such common refrigerants as freon and methyl chloride.

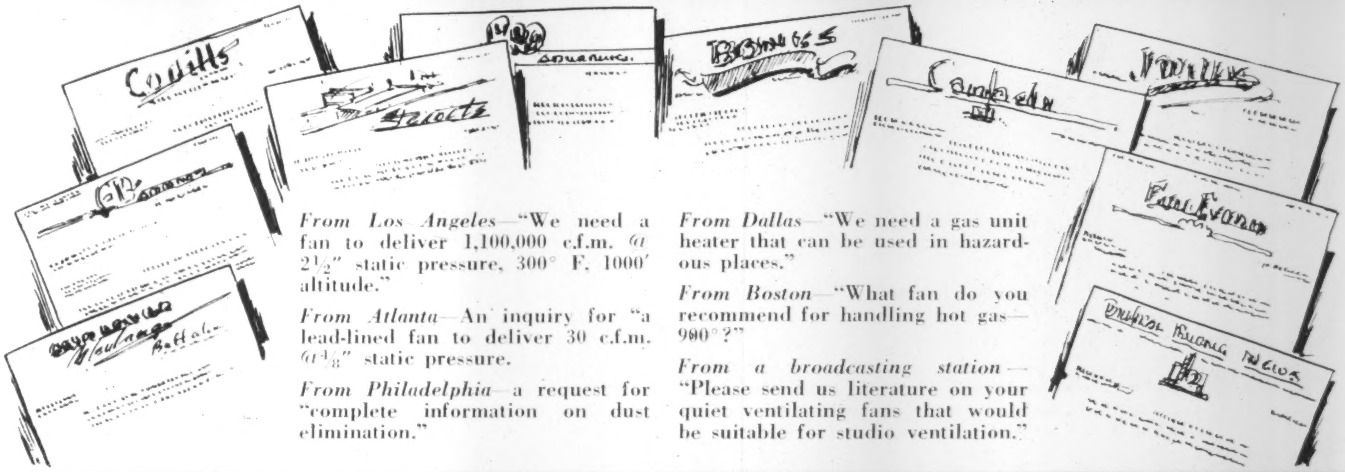
That's the reason leading air-conditioning manufacturers incorporate these Seamless Vibration Eliminators on their machinery. Contractors, installers, consulting and service engineers everywhere are recommending them. Stocked by leading air-conditioning supply dealers, American Vibration Eliminators are available in sizes up to 3" I. D. to fit *over* standard copper water tube or *into* "solder" fittings. Write for free descriptive Bulletin VE-2. 38346

American Metal Hose

ANACONDA
from mine to consumer

AMERICAN METAL HOSE BRANCH of THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut • Subsidiary of Anaconda Copper Mining Company

A Glimpse of our DAILY MAIL Tells the Story of "Buffalo" FAN *Engineering Service!*



From Los Angeles—"We need a fan to deliver 1,100,000 c.f.m. @ 2½" static pressure, 300° F, 1000′ altitude."

From Atlanta—An inquiry for "a lead-lined fan to deliver 30 c.f.m. @⅛" static pressure.

From Philadelphia—a request for "complete information on dust elimination."

From Dallas—"We need a gas unit heater that can be used in hazardous places."

From Boston—"What fan do you recommend for handling hot gas—900°?"

From a broadcasting station—"Please send us literature on your quiet ventilating fans that would be suitable for studio ventilation."

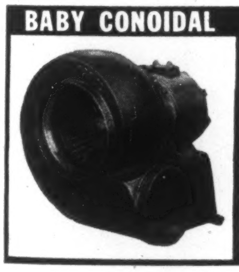
The inquiries quoted above, taken from our daily mail truly demonstrate the broad scope of Buffalo Fan Engineering Service.

The writers of those inquiries know that they can get the correct fans to solve their air handling problems regardless of size or special design if they bring those problems to Buffalo Forge engineers.

For over 60 years, we have been designing and building fans for industry. In fact, it would be difficult to name an industrial plant of the first rank that is not a Buffalo customer. We invite you to take full advantage of this experience whenever you have an air handling problem, be it the simplest form of ventilation or a complex air handling job.

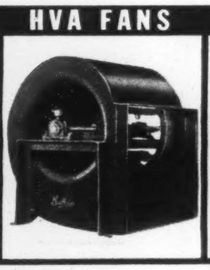
BUFFALO FORGE COMPANY
171 Mortimer St. Buffalo, N. Y.
Branch Engineering Offices in Principal Cities
In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

BABY CONOIDAL



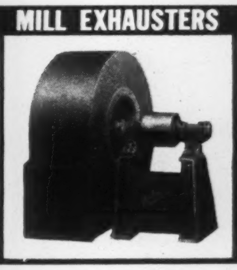
VOLUME FANS

HVA FANS

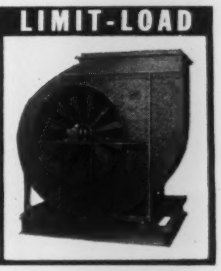


BREEZO FANS

MILL EXHAUSTERS



LIMIT-LOAD



STEAM TRAP NEWS

Published by ARMSTRONG MACHINE WORKS, 874 Maple St., Three Rivers, Mich.

TRAPSHOTS

By TRAPPER JOE

I always thought these camera fans were a bunch of anomalous ginks going around taking pictures of people with their mouths open and stuff like that, but I was up in the woods last summer and I met a fella with a camera who really was doing some mighty interestin' things.

* * * * *

This fella would set up his camera in the woods along with a flashlight bulb and an automatic trigger so that when animals came by they tripped the trigger and took their own pictures. Well, he used to have two or three cameras scattered all around for a couple of miles, taking pictures of deer and other animals.

Then one day this fella got an idea that he would like to get a picture of an animal right after that first picture was taken to see what his reaction was to the flash-bulb. Well, now, you'd be amazed at his results. He got a picture of a deer that way and you wouldn't know it was the same animal. By the time the second picture was made, the deer had time to react to the flash-bulb and it showed him up three feet off the ground and turning around in the air, his hair fairly standin' on end. That deer was just electrified into action.

* * * * *

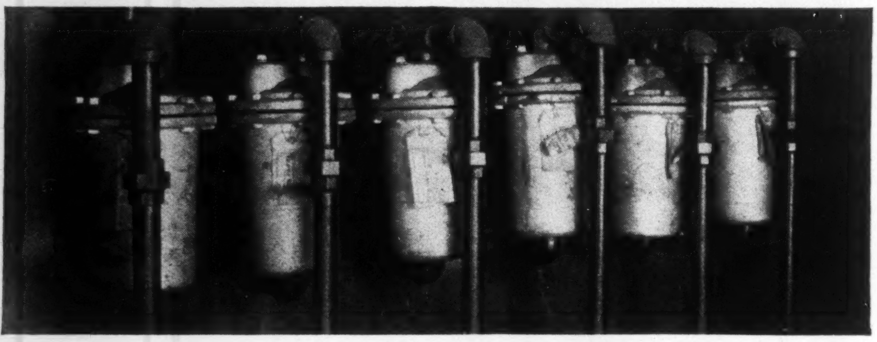
You know, I've seen steam equipment act like that—just give it a chance to react to an Armstrong trap, then Oh Boy! just watch it go to town!

THE QUESTION BOX

What is a simple, efficient method of getting rid of large amounts of air from big dryers, kettles, radiation pipes, etc.?

You can find the answer on page 13 of the new fourth edition of the Armstrong Steam Trap Book. Ask for your copy of this 32 page compendium of useful information about condensate drainage, steam traps, etc. It answers dozens of common questions and gives detailed information about Armstrong steam traps for every purpose. A postcard request is all that's necessary.

HIGH SCHOOL CUTS COAL BILL 50%; GETS IMPROVED HEATING SERVICE!



Every engineer likes to see a job done better and at a lower cost, and Mr. Charles Pillers, Chief Engineer of the Springfield City High School, Springfield, Ohio, is no exception to this rule. When he came to the school, he found the building poorly heated despite a coal consumption of 8 or 9 tons per day.

Mr. Pillers immediately created for himself the task of correcting the heating of that building, and at the same time reducing coal consumption. Did he do it? We'll say so! Here's how:—he called in engineers who made recommendations for the installation of some 30 Armstrong steam traps. And here are the results:

Coal consumption has dropped to a maximum of 4 tons per day or approximately 50% and the building is now properly heated throughout. In addition, a steam heated storage type hot water heater drained with an Armstrong trap has replaced 3 gas heaters and saved a $60 per month gas bill! The picture above shows six No. 214 Armstrong traps draining an indirect heater at the high school.

Greenhouse Saves 211 Tons of Coal

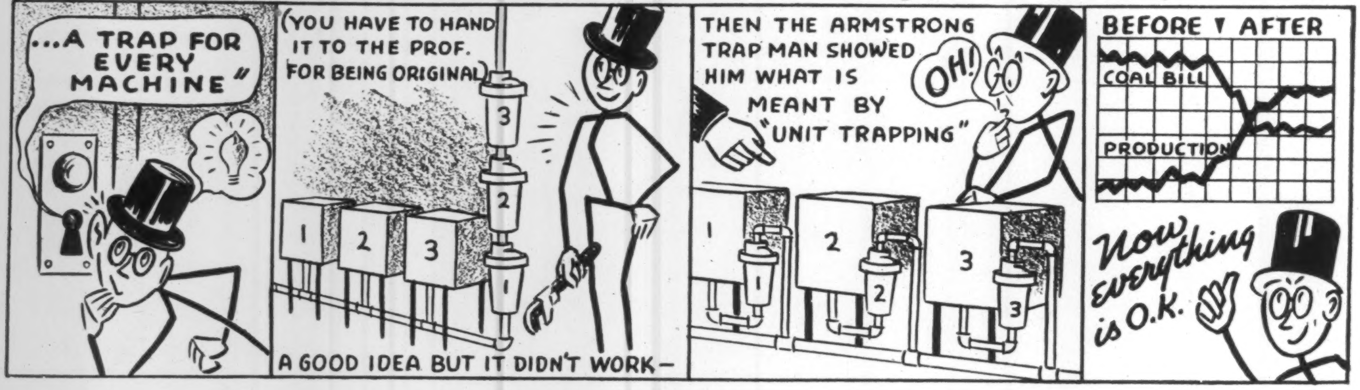
Terre Haute, Indiana—We certainly are pleased with our Armstrong Trap installation made last summer according to your recommendations.

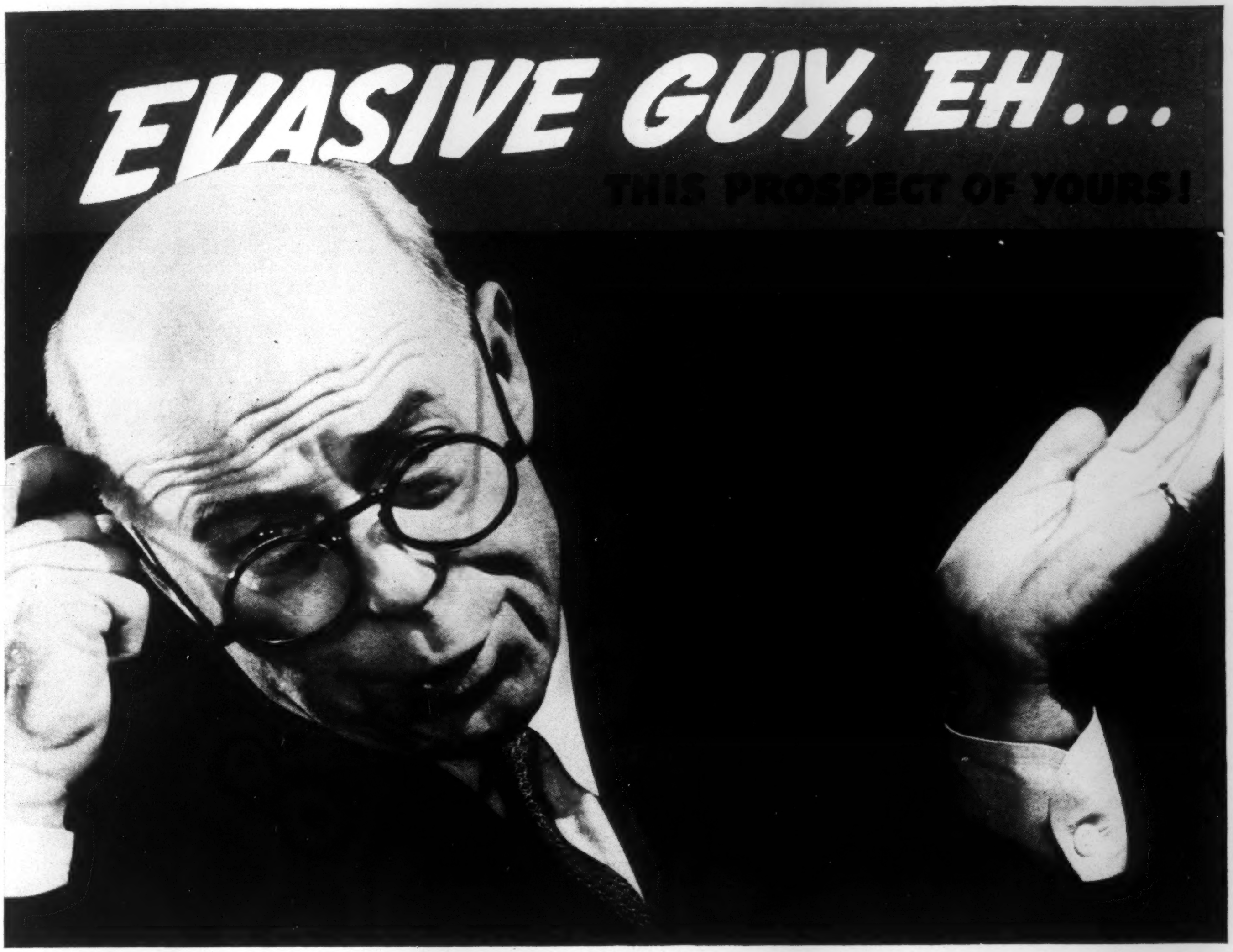
During the winter of 1937-38, we used 211 tons less coal than in 1936-37, with weather temperature comparable. The temperatures throughout our houses were practically constant, heretofore they varied greatly. We formerly carried 12 to 15 lbs. pressure normally, higher in severe weather. We dropped pressure to 7 to 10 lbs.—*H. B. Henley, Henley Bros.*

Cure Water-Hammering

A unit heater on an air conditioning system had a solenoid valve in the steam supply line controlled by a room thermostat. A small orifice in the seat of the solenoid valve would bleed steam into the coils to keep them warm while the valve was closed. Trouble resulted because this small amount of steam would condense as fast as it entered the coils, creating a vacuum that prevented drainage of the accumulating condensate. Then, when full steam pressure came on, severe water-hammering would occur. Study of the problem showed the solution to be the installation of a vacuum relief valve in the condensate line just ahead of the steam trap.

PROFESSOR CRACKPOT, D. C. D. (*Doctor of Condensate Drainage*) by BYE BLUES


"...A TRAP FOR EVERY MACHINE"
(YOU HAVE TO HAND IT TO THE PROF. FOR BEING ORIGINAL)
1
2
3
3
2
1
A GOOD IDEA BUT IT DIDN'T WORK—
THEN THE ARMSTRONG TRAP MAN SHOWED HIM WHAT IS MEANT BY "UNIT TRAPPING"
OH!
1
1
2
2
3
3
BEFORE ▼ AFTER
COAL BILL
PRODUCTION
Now everything is O.K.



EVASIVE GUY, EH...

THIS PROSPECT OF YOURS!

YOUR salesmen know him. He resorts to every subterfuge to evade the issue . . . to avoid saying "yes" while a salesman is present. He's afraid that the salesman's personality is influencing him. So he retreats behind a defensive mask of uncertainty. His stock answer is an evasive "I'll think it over" or "Have to discuss it with my associates". All a pose! He just wants to be *alone* when he makes up his mind.

It is when he is alone that he reads Heating, Piping and Air Conditioning. He isn't evasive then. He's looking for progressive ideas about heating, piping and air conditioning and news of the field. In Heating, Piping and Air Conditioning he is receptive to printed ideas—and that advertisement in Heating, Piping and Air Conditioning gives you the chance to get in some good licks between your salesman's call and the Evasive Guy's final decision.

Highest editorial standards and publishing integrity.

ABP

HEATING, PIPING and AIR CONDITIONING

←*bears the two hall-marks of known value*→

ABC

Proved reader interest in terms of paid circulation.

SANITARIUM ENJOYS BALANCED HEATING AT MODEST COST

Webster Moderator System Gives New Saratoga County Hospital Complete Heating Comfort

COMFORT IN COLDEST WEATHER

Open Window Ventilation, When Desired, Does Not Affect Economy or Comfort

"IDEAL" FOR HOSPITAL NEEDS

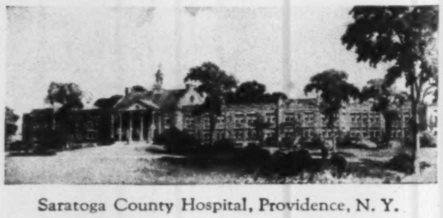
Providence, N. Y.—Built in 1937, the Saratoga County Hospital, a modern sanitarium for the treatment of tuberculosis, has secured comfortable, economical heating service with a Webster Moderator System of Steam Heating.

Hospital officials selected the Webster Moderator System because of its record of effectiveness in many similar installations. One season's experience convinced them of the soundness of their judgment.

Dr. A. R. Dimock, the Doctor-in-Charge, reports that even temperature and equal distribution of heat have been maintained during the severest winter weather.

"For heating comfort and minimum consumption of steam, the Webster Moderator System is ideal for our needs," Dr. Dimock said.

With the Webster Moderator System, heat is delivered continuously to all radiators. There is no on-and-off heating with its alternate "cold 70" and overheating. Moderate open-window ventilation, when desired, does not affect either the economy or comfort of the installation.



Saratoga County Hospital, Providence, N. Y.

"Control-by-the-Weather" is provided by an Outdoor Thermostat, which automatically adjusts the basic rate of steam delivery with every change in weather or wind direction. A manual Variator allows the operator to vary the steam supply to meet special conditions.

All of the installation work was done by Cohn & Kramer, well-known heating firm of Albany. There is a total of 14,000 sq. ft. of installed direct radiation. The Saratoga County Hospital was designed by William H. Vaughan, Saratoga Springs architect.

If you are interested in heating *new* buildings, or in improved heating service and lower heating cost in your present building, address

1888 WARREN WEBSTER & CO., CAMDEN, N. J. 1938

Pioneers of Modern Steam Heating

50 YEARS OF HEATING PROGRESS

Representatives in 60 principal U. S. Cities

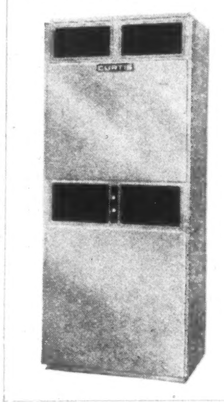
WEBSTER
MODERATOR
CONTROL
"Control-by-the-weather"

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 126. Add the new products and companies listed here to your Directory Section which you received in your January, 1938, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Store and Office Cooling Units

No. 1578*—The latest addition to a line of air conditioning and refrigeration equipment is a store and office cooler. It is a complete packaged air conditioning unit, factory designed, engineered and built to meet the requirements of all types of business. Available in both 3 and 5 ton capacities, it is semi-portable, as only water and electrical connections are necessary for installation.

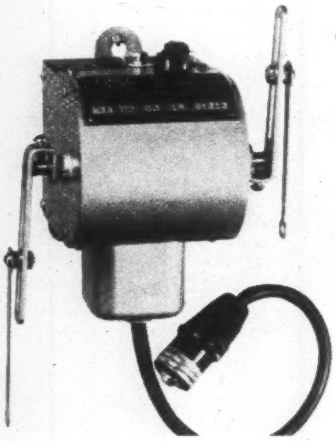


The cabinet is of heavy gage automobile steel, with a silver "Hammerloid" finish, or with a flat, prime coat ready to take any matching color. Cabinet is lined with special insulating and sound absorbing material. Control is accomplished by two small dials on the front of the cabinet.

Occupying but 5½ sq ft of floor space the unit cools, dehumidifies, circulates and filters, and is adaptable for heating for year 'round air conditioning.—Curtis Refrigerating Machine Co., 1950 Kienlen Ave., St. Louis, Mo.

New Motor Operators

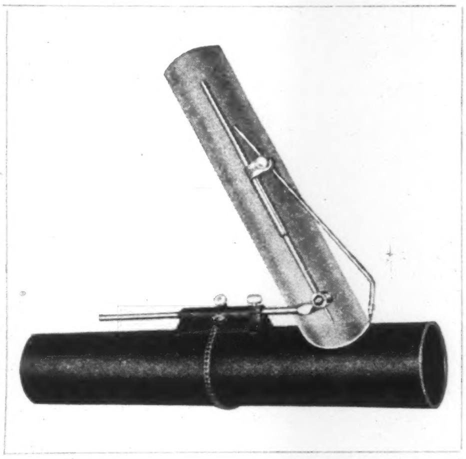
No. 1579*—This new motor operator (or damper motor), one type of which is illustrated, is employed to give effect to the automatic control provided by thermostats, aquastats, pressurestats, furnacestats, humidistats, effective temperature controllers, and similar sensitive instruments themselves without recourse to electrical relays. The motor operator is used on low voltage, which is furnished to the control circuit and the motor by the secondary of simple transformer which is supplied with each motor operator, from 110 or 220 volt a-c supply lines, according to specifications.



These operators are provided with auxiliary hand switches giving manual on, off, or automatic positions and also with arms which are adjustable in position and which are in turn connected to the draft damper of coal fired furnaces or boilers, to the duct dampers of air conditioners or warm air systems, to zone dampers, bypass dampers of conditioners, etc.—Julien P. Friez & Sons, 4 N. Central Ave., Baltimore, Md.

Layout Device for Pipe Joints

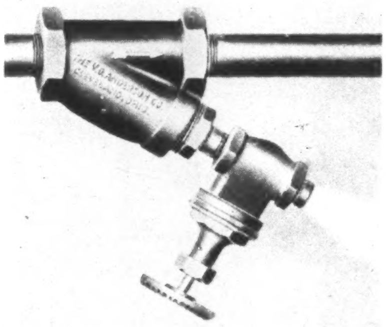
No. 1580—The new mechanical "Pipe-Scriber" is designed to assist welders in easily, quickly and accurately making layouts for practically all pipe joints. The layouts can be made directly on the pipe or for patterns if desired. The device can be used on pipe sizes ranging from 2 to 12 in. A six way adjustment permits an accurate layout for every angle and joint, states the maker.



An interesting part of the unit is the marker crayon which is of a special fire resistant composition. The mark made by the crayon will not blow off under the cutting torch flame but assumes a reddish glow, which is easy to distinguish and follow while cutting.—Harris Calorific Co., 5501 Cass Ave., N. W., Cleveland, Ohio.

Self-Cleaning Strainers

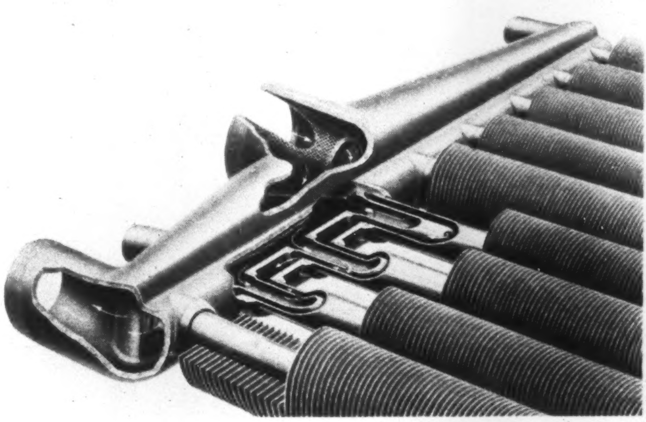
No. 1581—New self-cleaning strainers announced last month are of alloy cast iron with stainless strainer elements and are designed for gases or liquids on pressures up to 250 lb at 450 F. Where temperatures do not exceed 250 F, these strainers are satisfactory for pressures up to 300 lb.



They are made for pipe sizes of ¼, ⅜, ½, ¾, 1, 1¼, 1½ and 2 in. Over-all length of the smallest unit is 3¼ in. and that of the largest is 7¾ in.—V. D. Anderson Co., 1949 W. 96th St., Cleveland, Ohio.

Non-Freezing Heating Coils

No. 1582—The "Non-Freeze" coil illustrated has been developed to solve the problems of effective prevention of freezing of steam coils in the cold air stream, maintenance and control of uniform temperature, and the elimination of stratification by thoroughly distributing steam over the entire face of the coil even when steam is throttled for partial loads during freezing weather. The design is ingenious; steam supply and return



Something New to Crow About

HYDRAULIC ACTION CONTROL FOR HEATING . . . AIR CONDITIONING . . . FURNACES . . . HOT WATER . . . REFRIGERATION . . . OVENS . . . FANS

And Here's Why

The Friez Hydraulic Action Principle—using a "solid liquid charge" is essentially a sound one . . . for the liquid is gas free and possesses expansion characteristics of solid steel.

Hydraulic Action offers permanent accuracy and fine differential of control—at a cost you can't afford to overlook.

Hydraulic Action provides sturdy construction to which simple installation and maintenance; plus sustained performance through a long life are logical results.

Hydraulic Action provides a heavy duty switch, high contact pressures and high load capacity.

We'd like to tell you more about these new and amazingly simple controls which offer superior performance, permanent accuracy and fine differential.

Just jot your name below and mail the Coupon Today.

Send me details on the New Hydraulic Controls

Firm
Address
Atten.
Position

JULIEN P. FRIEZ & SONS.—BALTIMORE, MD.
Division of Bendix Aviation Corporation

are situated at the same end of the unit and the coil is comprised of a tube within a tube, steam being introduced in the perforated inner core through the orifices of which it passes to the outer tube. In the latter, the condensate flows *back* parallel to and in contact with the heated core to assure against freezing and stratification. According to the maker, this design eliminates the cold end, and variable temperatures over the face, also excluding the possibility of the condensate freezing at any percentage of heating capacity.

This coil is made in a single row and gives a temperature rise of from 0 to 81 F at 5 lb steam pressure and 500 ft face velocity. Where the temperature rise is less, as in ordinary ventilation, there is no need for a tempering or preheater coil ahead of it, the manufacturer states.

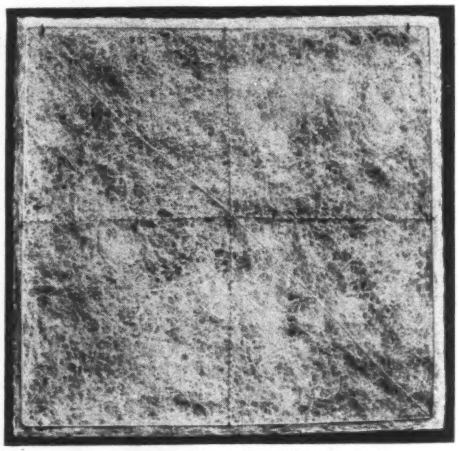
The coil is constructed entirely of non-ferrous materials and the header is made of one piece bronze casting. A strainer is required in the steam main ahead of the coil to prevent scale and other foreign particles from entering.—Aerofin Corp., 410 S. Geddes St., Syracuse, N. Y.

Filter for Industrial Oil Burners

No. 1583**—A new oil filter developed for service on industrial oil burners and oil trucks has a filter element consisting of cotton yarn wound into tubular form and inserted in the filter shell. According to the maker, this filter element will not rupture, channel, bypass, or disintegrate, and it assures an oil supply free of dirt, scale, abrasives and gummy residues to prevent scored pumps and clogged nozzles.

The filter can be renewed by taking off the cover, removing the old element and inserting a new one, no special tools being necessary. It will handle 5000 gal of average grade No. 3 furnace fuel before flow is retarded and replacement becomes necessary, the maker states.—Commercial Filters Corp., 16 Macallen St., South Boston, Mass.

Air Filter Pads



No. 1584—Illustrated is a recently introduced air filter which is made in all standard sizes and in special sizes upon request. These "Axiom" pads may be obtained flame-proofed, or non-flame proofed, as desired, the flame-proofed filters having a somewhat lower efficiency than the others.

These filters are made up of curled hair and vegetable fiber and are treated with a special odorless non-run oil. According to the manufacturer, tests have indicated an over-all efficiency of 95.6 per cent with an air volume of 758 cfm and a dust concentration of 0.8 grams per 1000 cu ft of air. The filter was fed 200 grams of dust and the test period was 5½ hrs. Initial resistance was 0.091.—Blocksom & Co., Michigan City, Ind.

Announcing the New CURTIS Store and Office Cooler

a new Money-Maker for you!

● The new Store and Office Cooler is the latest addition to the Curtis line of air conditioning and refrigeration equipment. It is a complete, packaged air conditioning unit, factory designed and engineered—cools, dehumidifies, circulates and filters and is adaptable for heating too. It's semi-portable, requiring only water and electrical connections, and makes economical, dependable cooling available for all types of business. Available in 3 and 5 ton sizes.

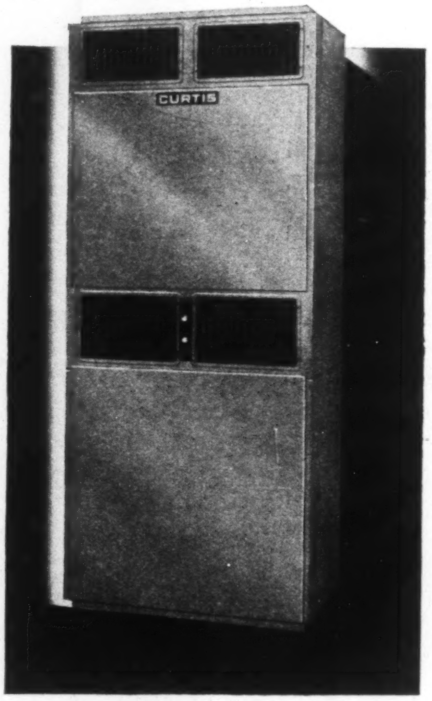
Thus the Curtis line becomes more complete than ever with the Store and Office Cooler, giving Curtis dealers an even wider opportunity for greater sales and profits. You can cover the field with Curtis equipment—Curtis experience and Curtis engineering assure user satisfaction.

CURTIS REFRIGERATION AIR CONDITIONING AND COMMERCIAL

Write to Curtis for details today.

Curtis Refrigerating Machine Co.
Division of Curtis Manufacturing Co.
1950 Kienlen Ave. St. Louis, Mo.

"Builders of Condensing Units Since 1922"



The Welded Steel Burnham ranges in capacities from 1800 to 42,500 sq. ft.

The Cast Iron Burnham is made in twin sections so it can be passed through any average door. No tearing out necessary. Used extensively for replacements.

Hank

Talks Hoss Sense About Two Donkies That Ain't

Ever do any figuring on a piece of paper, or maybe a board, what raising the devil more'n you need, costs the feller who pays the bills? Meaning mostly the two donkies — *tearing out* and *tearing down*, when neither is needed doing.

Take the replacing of steel boilers. Why get so all het up, busting a big hole in the building, to get the gol durn old boiler out, and making the hole maybe bigger even yet to get another big steel boiler back in? Most boilers are not set in places so allfired crowded, they can't be just pushed aside. Then you can move in a Burnham Twin Section through the same door you cum in yourself, and not even nick the frame so much as any.

'Course, if you are friendlier fur a steel boiler than a cast iron, then that's another hoss the same color. Being as how we make both steel and cast iron, we favor 'em both. Both are built to a *specification* and a *reputation*. Some makes of boilers only has the specification. Which ain't enuff for engineering fellers like you.

Hank Hindle

Burnham Boiler Corporation
Manufacturers of Heating Equipment
Since 1873
IRVINGTON, NEW YORK ZANESVILLE, OHIO
Export Department, 50 Church Street
New York

Burnham Boiler

PARAMOUNT PREVIEW THEATRE
NEW YORK CITY
CHARLES C. BURTON, ARCHITECT

Draftless Air Distribution

COMBINED WITH
INDIRECT LIGHTING

The problem of air distribution in combination with indirect lighting in this modern Preview Theatre of Paramount Pictures Inc. was solved by the architect—Charles C. Burton—by the use of Anemostats to the complete satisfaction of the owners. The Anemostats provide equal distribution of the conditioned air both winter and summer, free from annoying and harmful drafts. Lighting units concealed behind the outer cones of the Anemostat throw light on to a plaster cove. With this "Anemostat Lighting Combination" many unusual and colorful lighting effects are obtainable by the insertion of colored lamps in alternate sockets.

The air distribution problem of any air conditioning or ventilating system, regardless of size, can be solved by the use of Anemostats. Anemostats can be applied to existing systems as well as to new installations. The Anemostat has no moving parts and is easily installed. Our catalog "The Anemostat Combined with Indirect Lighting" is of particular interest to engineers and architects doing theatre work and may be obtained upon request.

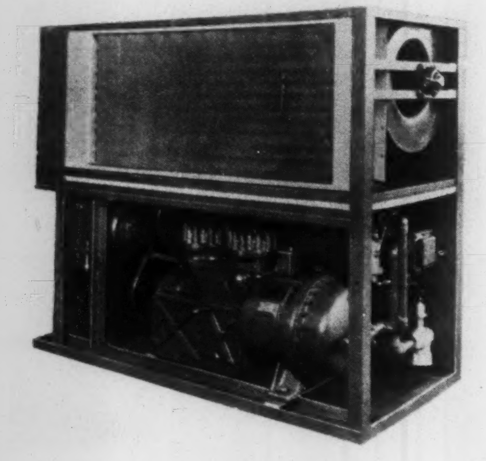
ANEMOSTAT CORPORATION OF AMERICA
10 East 39th Street, New York City

ANEMOSTAT
"No Air Conditioning System is better than its Air Distribution"

AN-28-A

New Self-Contained A. C. Units

No. 1585—A line of "packaged" self-contained "Unitaire" air conditioning units for commercial establishments, ranging in capacity from one to 15 tons and in combinations up to 30 tons has been announced. Three of the units are central system type and four are the type for installation within the conditioned space. Factory engineered and built, these new units are a complete air conditioning system packaged in a compact enclosed cabinet.



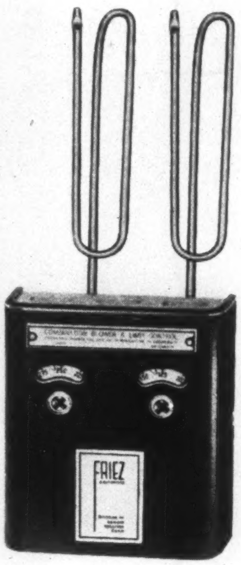
All that is necessary for operation are power, water and drain connections. Requiring little floor space (the largest is 2 ft 10 in. by 6 ft 6 in. by 5 ft 4 in. high) every unit can be carried through a 3 ft door opening.

The new units employ hermetically sealed compressors. Two switches permit flexibility of operation, one controlling the entire cooling mechanism and the other the blower motor so that air circulation may be employed when cooling is not necessary. All-steel welded cabinets insure permanent rigidity.

The units of the new line are adapted to winter air conditioning by the installation in the cabinets of the necessary accessories, such as heating coil and humidifier, thereby providing year around air conditioning with all its added advantages.—Westinghouse Electric & Mfg. Co., East Springfield, Mass.

Hydraulic Action Controls

No. 1586—Solid liquid filled hydraulic action thermal systems form the basis of a new line of controls just announced. Great advances are claimed by the maker for this hydraulic action system, which is sealed permanently both in respect to sensitive element and switch. Load carrying capacity is high (25 amperes at 20 volts, 15 amperes at 240 volts).



The fan or warm air limit switch, an example of which is illustrated, has fast sensitivity, adjustable differential and is available in simple or combined forms, including two speed types for either three or five lead motors. Limit controls for hot water and steam systems are shortly to be available.—Julien P. Friez, Inc., 4 N. Central Ave., Baltimore, Md.

Cabinet Top Grilles

No. 1587—A line of cabinet top grilles for room coolers, air conditioners, humidifiers and other heating and air conditioning equipment is available in five different designs and different price ranges, and complete data on construction, air capacity, prices, etc., may be had.

Reducing the Family Budget . . .

AP valves in Locker Room Storage Systems . .

Three temperatures are important in Locker Storage—chilling, freezing, and storage. The efficiency of each depends upon a minimum fluctuation that only unusual Valve sensitivity can provide. A-P Thermostatic Expansion Valves are offering this sensitivity and accurate temperature control in locker storage plants everywhere.

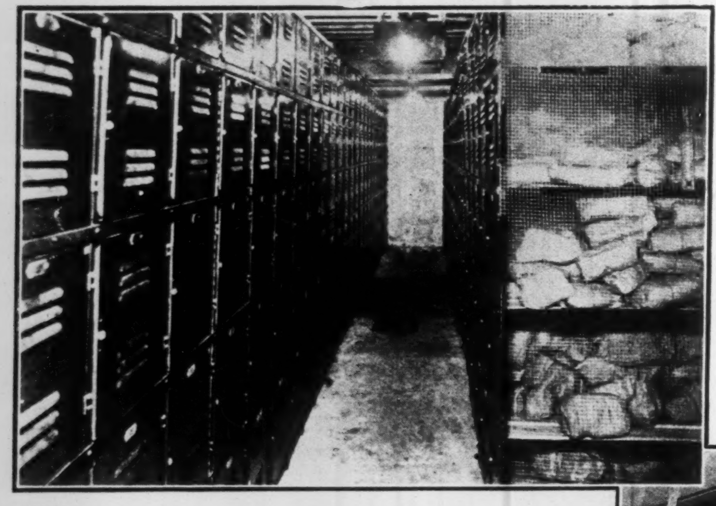
Here's sure protection to your patron's meats and foods—and service-free operation in every unit of the Locker Storage Plant. This combination always means maximum profit on investment for the owner—and complete satisfaction for the installing and service engineer.

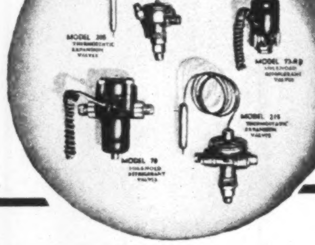
NOTE . . .
The thick layer of frost on A-P Valve. Despite this, the Service Engineer writes: "A-P Valves operate much better than the valves we had on before. For one thing, we can come closer to flooding the coils than with previous valves."

AUTOMATIC PRODUCTS COMPANY
2460 North Thirty-second St.
Milwaukee, Wisconsin

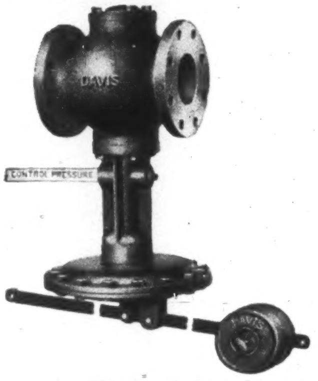
- Refrigeration Parts Jobbers, who recognize quality, stock A-P Controls.

DEPENDABLE
THE BYWORD FOR A-P VALVES





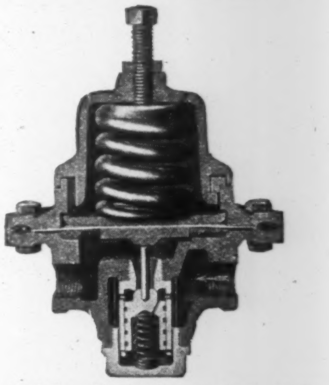
PRESSURE REGULATORS FOR EVERY PURPOSE



No. 15—This is a balanced, counterweighted diaphragm type regulator especially designed to give sensitive low pressure regulation on vapor heating systems. Unaffected by supply pressure variations. Packing boxes are eliminated; hence no leakage, no stem friction.

THE Davis line of automatic pressure reducing valves is complete—there is a type and size available to fit any job whether it be on steam, air, gas, water, or oil. The line includes a full range of regulators suitable for dead-end service as well as continuous flow. Davis recommendations are not biased by any favored types. As the job dictates, you are free to choose between direct or pilot control . . . spring or weight loading . . . piston or diaphragm action. Standard sizes range from 3/8 in. to 24 in. for pressures up to 1500 lbs. Larger sizes available on special order. You have your choice of the degree of sensitivity needed for the job—you don't have to pay for more than you need.

CHOOSING the right size and style is made easy by the Davis Regulator Service Chart and Capacity Charts. Specifications and ratings according to service. *Write for copies or see them at your jobber's.* DAVIS REGULATOR CO., 2546 S. Washtenaw Ave., Chicago, Ill.



No. 13—Truly the modern regulator for unit heaters, water heaters, laundry ironers, sterilizers, vulcanizers, etc. Spring cap removable by hand—Built-in strainer—All parts accessible without breaking pipe connections—Tight closing—For steam, air, or gas service.

DAVIS REGULATOR CO.

DAVIS VALVES

PRESSURE REGULATORS • STOP AND CHECK VALVES • LIQUID LEVEL CONTROLLERS • BACK PRESSURE VALVES
STRAINERS • PUMP GOVERNORS • BUTTERFLY VALVES • FLOAT VALVES • RELIEF VALVES • SOLENOID VALVES
MOTOR OPERATED VALVES • NON-RETURN VALVES

. . . with the greatest of ease!

HANDSPRINGS or backflips, the acrobat who gets the spotlight practices *fast turnover*—just as do Webster-Nesbitt Unit Heaters, whose success depends on fast turnover of air. By adding heat in moderate amounts to substantial air volume by a rapid turnover of the heated air, proper air mixture and uniform temperature are assured. Stratification is minimized, wasteful heating of upper areas is prevented. Send for the Webster representative. His suggestions should prove invaluable in the successful application of unit heaters to your problem. FREE CATALOG on request.

WEBSTER-NESBITT GIANT HEATERS *are recommended for heating very large enclosures, operating on the same proved principle of rapid air turnover. Send for particulars.*

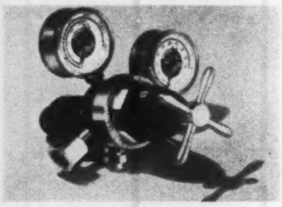
Webster Nesbitt
UNIT HEATERS

Manufactured by JOHN J. NESBITT, INC., Holmesburg, Phila., Pa.
Distributed Exclusively in the U. S. A. by WARREN WEBSTER & COMPANY, Camden, N. J.
Address Nearest Webster Sales Office—Consult Your Telephone Directory

One of the designs is made up of a number of thin strips formed into a series of grooves; a second is made up of a number of v-shaped fins; a third is pressed from one piece of steel, the formed down section being set at an angle of 45 deg; the fourth design may be rotated through an arc of 90 deg (45 deg either way from straight) to obtain a large variety of directional flow settings; and the fifth design is a perforated grille with 3/8 in. by 7/8 in. openings and 1/8 in. frets, for use where directional air flow is not required.—Hart & Cooley Mfg. Co., 61 W. Kinzie St., Chicago, Ill.

Oxygen and Acetylene Regulators

No. 1588—Three new regulators were announced last month: the "Purox" oxygen regulator, type R-201, for ordinary welding and light cutting; the type R-202 oxygen regulator for heavy duty cutting; and the type R-203 acetylene regulator.



They utilize the principle of two stage regulation. A fixed first stage reduces the pressure of oxygen or acetylene from cylinder pressure to a moderate figure, below which it is regulated by the variable second stage of regulation. Stem type valve mechanisms insure a uniform flow of oxygen and acetylene at the lower pressures at which the gases are used and in quantities sufficient for practically all welding and cutting operations. The monel metal valve stems are distinct from the diaphragms to eliminate possibility of stem distortion due to diaphragm pull caused by leakage. Accurately machined guides assure correct alignment of the stems. Heavy valve closing springs give positive seating action.—The Linde Air Products Co., 30 E. 42nd St., New York, N. Y.

Booklets, Reports and Papers

Choosing the Proper Air Conditioning System

Robert E. Hattis, consulting engineer, spoke before the Great Lakes Power Club in Chicago last month on choosing the proper air conditioning system. He discussed the functions and applications of air conditioning, and the requirements that must be met in both winter and summer.

In concluding, he reviewed in general terms the types of equipment available for use, as follows:

"1. The self contained units are offered for the smaller jobs. If they are equipped to take in outside air they are suitable for as large a space as the air diffusion properties and capacity of the unit permits. The outlets must be low, and in deep spaces the parts remote from the unit will not be cooled properly. If they are not equipped with outside air intakes, their use is limited to spaces which do not have a dust, odor, smoke, or contamination problem. The self contained units are practical for small offices and the smaller stores.

"2. The central plant unit using duct work and equipped with one compressor and one direct expansion cooling coil is suitable for larger areas, all of which space has practically identical occupancy and time of use. If the area has two or more parts, any of which vary considerably in occupancy or time of use, such an installation should be equipped with separate conditioners or be handled in another manner. If the people load is great, and the percentage of outside air required large, then the coil should be divided with more than one compressor used, varying compressor speed, or cutting out cylinders; or a water chiller may be used and the cooling effect kept continuous but varied by throttling.

"3. Where several spaces must be handled, each of which

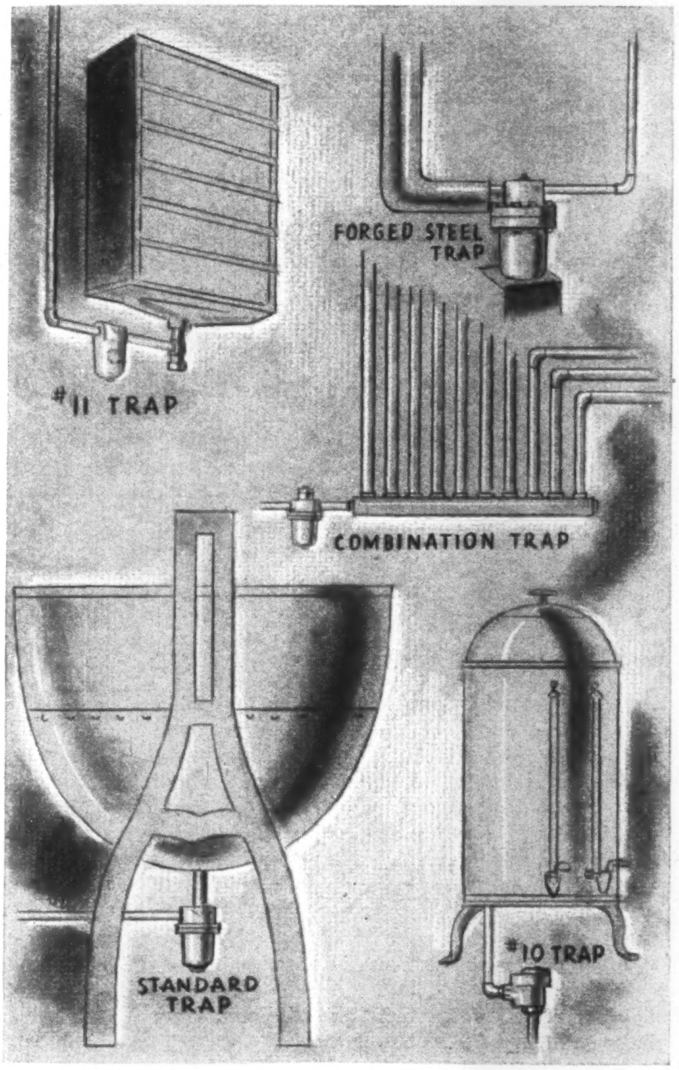
BANKS
TRAYS
BLOWERS
DUCTS
COILS
AIR WASHERS
SPRAY CHAMBERS
COOLING COIL HOUSINGS
wherever CORROSION
is a major factor...
always specify
HUSSEY PURE LAKE COPPER

Because it's a pure lake copper, you get the "extra-special" advantages of a copper fortified by Nature to give the longest service under the severest conditions of air conditioning. That's why Hussey Pure Lake Copper is being so widely used by heating and air conditioning contractors. It's an extra quality copper sold at a regular price. Ask us about it.

HUSSEY
Copper Brass

C. G. HUSSEY & COMPANY
(Division of Copper Range Co.)
Rolling Mills and General Offices: Pittsburgh, Pa. Warehouse Stocks in the Principal Cities

There's a
SUPER-SILVERTOP
FOR EVERY PURPOSE



● From pressures of a fraction of a pound up to 700 pounds per square inch—from capacities of 200 pounds of condensate per hour up to 60,000 pounds—for conditions requiring a trap with the ability to handle extremely large volumes of air or for any other difficult installations—there's an Anderson Super-Silvertop steam trap to suit your requirements in heating and processing work.

In addition, Anderson Super-Silvertops offer the savings from simplified piping and accessibility without removing the traps from the line. Find out all about this trap with the year-ahead design. Write today for complete information.

THE V. D. ANDERSON COMPANY
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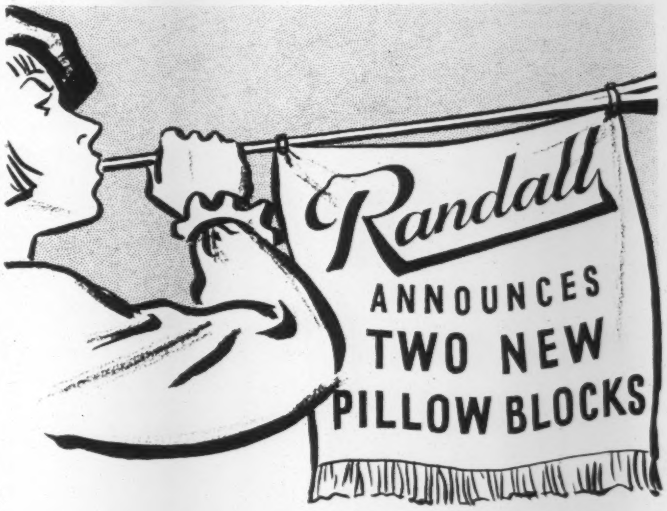
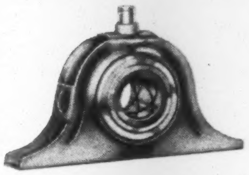
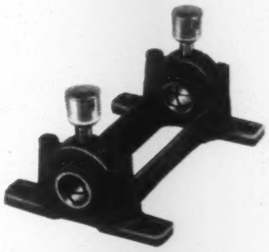


QUIET — STURDY — EFFICIENT



ONE-PIECE STEEL HOUSING PILLOW BLOCK

This new patented low price pillow block is constructed of only 3 parts, a one-piece steel housing, a new cast iron ball with greater oil capacity, and a patented bronze bushing. Because of its simple structure it is lighter in weight yet sturdy enough for any application, and much lower in price. It is self-lubricating, self-aligning and has the same quality of endurance that makes Randall Pillow Blocks outstanding.



*DUPLEX STANDARD PILLOW BLOCK

The Duplex has been designed to provide rigidity in attic fan applications eliminating vibration due sometimes to light construction and overhung impeller wheel and V-belt drive pulley. Two Standard Pillow Block bases cast integrally, provide a strong, rigid one-piece base that will not distort yet permits full alignment of the shaft at all times. Like all Randall bearings, the Duplex operates quietly with a maximum of efficiency and a minimum of attention. It can be mounted vertically if elbow oilers are specified.

**Large oiler shown at slight extra cost.*

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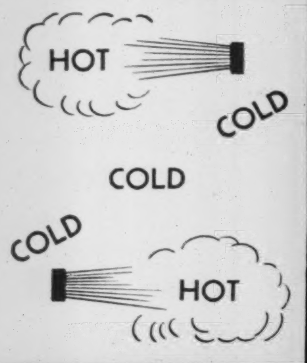
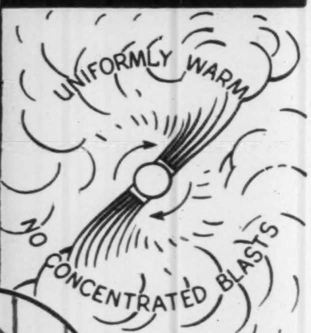
***Randall* GRAPHITE PRODUCTS CORP.**
Dept. 1210 609 W. Lake St., Chicago, Ill.

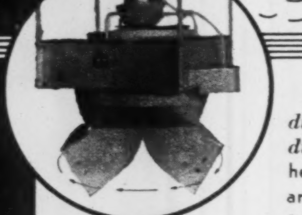
Heating Buildings



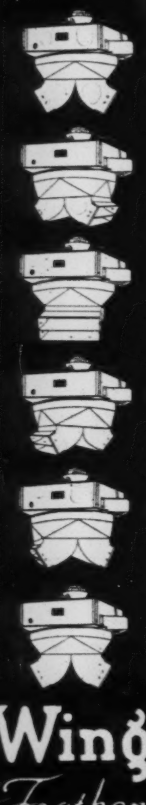
If the presence of hot spots and cold spots in your buildings is immaterial to you—you'll not be interested in this information

But if you wish to *avoid* them and improve the efficiency of your workmen and equipment and to preserve perishable goods here's information of vital interest to you.





Diffuses heat in every direction



Greatest possible *distribution* and *diffusion* of the heat delivered is an outstanding feature of the new Wing Revolving Discharge Unit Heaters.

Their constantly moving, slowly rotating discharges eliminate difficulties encountered in certain plants where machines or other equipment obstruct the flow of heat from fixed discharge heaters.

Furthermore, one large Revolving Discharge Wing Unit takes the place of several one-direction heaters at less cost for units, piping, wiring, accessories, and installation.

These units have solved some very vexing heating problems, such as on fruit piers where perfectly even temperatures are essential.

Write for complete information today.

L. J. Wing Mfg. Co.

(The Pioneer of Ceiling-Suspended and Lightweight Unit Heaters)

14th St. and 7th Ave. New York, N. Y.

Wing Revolving Discharge

Featherweight UNIT HEATERS

Floodlights of Heat

has varying occupancy, load and time of use, a large central water chilling plant may be used, with the water pumped to small central plants situated in or near each space served, with continuous throttled cooling. When the spaces vary only in load but are used at the same time, one fan system with booster coils in the branch ducts may be used.

"4. For spaces requiring a large tonnage for a small percentage of the time, a small refrigerating machine can be operated a long time to store the large amount of cooled water required to handle the big load. Of course, the conditioning unit and duct system must be as large as the load requires. The compressor can be smaller and its electric, water and waste demands less.

"5. Where the people load is great, or much outside air is required, means should be provided for drying the air independently of the cooler. Equipment using lithium chloride or silica gel makes this possible. Where the internal moisture load is not great, a central dehumidifier, compressor operated, can be used to supply the outside air properly treated."

Report on Air Conditioning

The 1938 report of the industrial and commercial air conditioning committee of the industrial gas section of the American Gas Association is a comprehensive discussion of "where summer air conditioning by means of heat energy stands today in industrial and commercial fields." Charles R. Bellamy, Columbia Gas and Electric Corp., is chairman of the committee which prepared this 70 page report.

Sections are included on industrial air conditioning, commercial air conditioning, residential air conditioning, and performance and other data on a number of installations are given. There are also sections on qualifying gas heat energy in summer air conditioning, the progress and possibilities of gas summer air conditioning with dehumidifiers, and gas air conditioning by the liquid absorption method.

Also included in the report is an address by Charles S. Leopold, consulting engineer, which was given at the annual convention of the A. G. A. in October. It is abstracted as follows:

"For equal sensation of warmth or coolness with air motion of 15 to 25 fpm for average persons between the ages of 20 and 70 in health and in the range of conditions where normally clothed people are reasonably comfortable, one degree Fahrenheit increase in dry bulb temperature is compensated by approximately (a) 7 per cent to 10 per cent decrease in relative humidity; (b) 9 grains per lb decrease in absolute humidity; (c) 0.056 in. mercury decrease in vapor pressure; (d) 1.1 Btu per lb decrease in total heat.

"Commercially, most satisfactory conditions are obtained with relative humidity of from 30 per cent to 55 per cent provided the dry bulb temperature is properly compensated. Assuming 50 per cent relative humidity and reasonably long exposure in the conditioned space, optimum results are secured from 76 F to 77½ F dry bulb and satisfactory results are secured from 76 F to 79 F.

"Obtaining the same effective temperature by lowering humidities will result in an increase in the total heat balance.

"A temperature of 83 F with a relative humidity of 30 per cent is the practical upper limit in temperature when taking full advantage of dehydration.

"Experiments thus far indicate that the magnitude of the entrance shock and the rate of disappearance of perspiration are not appreciably affected by variations in relative humidity from 30 per cent to 60 per cent, providing the effective temperature is constant.

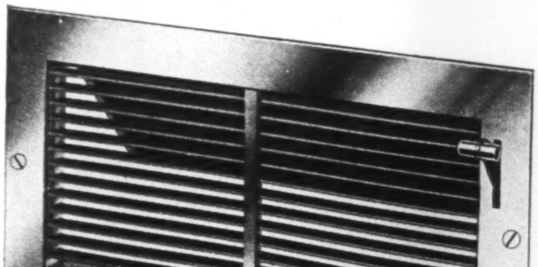
"Controlled tests have shown that there is no specific relation between inside and outside dry bulb or, within limits, with the inside and outside relative humidities. The small correlation for day to day changes is properly a function of the difference between inside and outside effective temperatures."

In his discussion, Mr. Leopold referred to an effective temperature designation describing the effective temperature line in terms of the dry bulb temperature at 50 per cent relative humid-

1st IN NEW YORK

It is significant that Tuttle & Bailey Flexair Registers were selected for all supply outlets in New York's first apartment building with complete INDIVIDUAL AIR CONDITIONING and HUMIDITY CONTROL, at 25 East 83rd Street.

Behind each supply outlet in this completely modern building is a metal plate specially designed by the consulting engineer. The Flexair register, scientifically designed to provide adjustable deflection of the air stream, fits pleasingly but unobtrusively into the lovely surroundings.



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NEW BRITAIN CONN.
BOSTON NEW YORK PHILADELPHIA CHICAGO

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Sylphon
TRADE MARK
FOR
TEMPERATURE
CONTROL

• of Service Hot Water

Sylphon Thermostatic Water Mixers effectively limit the maximum temperature of hot water delivered to bathrooms, gang showers and kitchens, below the scalding point regardless of storage tank temperatures.

Utilizing hot water from any usual source, they regulate the amount of cold water required to temper the hot to the desired degree, actually mixing the two together before delivery.

Uneffected by sudden fluctuations in temperature or pressure of supply water, they assure accurate maintenance of safe temperatures, protect porcelain and plumbing fixtures. They not only save hot water but effect increased capacity of storage tanks by permitting water to be stored at higher temperatures.

The complete line ranging from sizes for individual showers to sizes for entire sections of large residential, commercial and industrial buildings, is described in bulletin XE 40. Ask for it.

•

OTHER SYLPHON BULLETINS

Individual Room Temperature Control — Bulletins XE 80 and XE 70 . . . Zone Control—Bulletin XE 70 . . . Space Heat Control in Large Industrial Areas — Bulletins XE 50 and XE 70 . . . Duct Type Heating and Air Conditioning Controls—Bulletin XE 50 . . . Drinking Water Temperature Control—Bulletin XE 20.

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TALLMADGE
Zoned Controlled
HEATING

The ZONE CONTROL VALVE used in Tallmadge Zoned Heating frequently permits a large reduction in installation costs by using small high pressure piping direct to the Modulating Zone Control Valve without the use of reducing valves.

BETTER HEATING AT LESS COST
GIVES GREATER COMFORT
Improves Air Conditioning

WEBSTER TALLMADGE & CO.
NEW YORK CITY

ity, and he designated this reference as "ET$_{50}$." Effective temperature lines are usually designated by their corresponding temperature at 100 per cent relative humidity, said Mr. Leopold but since we are not accustomed to atmospheres at or near saturation, and have a fair appreciation of the feeling of temperatures at 50 per cent relative humidity, he used both designations—that is, the one based on 100 per cent relative humidity and on 50 per cent relative humidity.

He concluded his talk by drawing attention to the value of the experimental work on temperatures and humidities, and the futility of conclusions drawn from a few personal observations not accompanied by accurately controlled tests. Even with controlled tests, there is danger in generalizing when dealing with the complex problem of human physiology, and he acknowledged his own limitations in these respects.

The entire report concludes with recommendations of the industrial and commercial air conditioning committee, among which are that all gas company sales offices in large cities and towns be air conditioned; that all gas companies make comprehensive studies of their local weather conditions, water supply, rates, facilities and services; that there be closer contact and better cooperation between gas companies and the engineering firms and contractors that handle air conditioning equipment, for it is believed that there are many sound reasons why industrial and commercial air conditioning installations should be made by such firms rather than by the utilities; that competition between electric and gas companies should be friendly, fair and constructive, there being at the present time no single system—either electric or gas—which is best for all situations, and the purchaser's interests should be the determining factor; that more publicity be given successful gas installations; that the A. G. A. should encourage constructive research efforts having to do with the utilization of gas for air conditioning; and that the executive board of the A. G. A. should be requested to provide funds to sponsor research and development in summer air conditioning.

Conventions and Expositions

American Society of Mechanical Engineers: Annual meeting, December 5-9, New York, N. Y. Headquarters office, 29 W. 39th St., New York, N. Y.

Power Show: National Exposition of Power and Mechanical Engineering, December 5-10, Grand Central Palace, New York, N. Y. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

American Society of Refrigerating Engineers: Annual meeting, December 6-8, Hotel Commodore, New York, N. Y. Headquarters office, 37 W. 39th St., New York, N. Y.

National Warm Air Heating and Air Conditioning Association: 25th anniversary convention, December 12-14, Netherland-Plaza Hotel, Cincinnati, Ohio, Managing Director, Allen W. Williams, 50 W. Broad St., Columbus, Ohio.

Symposium on Fluid Dynamics: December 27-28, Carnegie Institute of Technology, Pittsburgh, Pa., sponsored by division of industrial and engineering chemistry, American Chemical Society. Secretary-Treasurer, Howard S. Gardner, Engineering Department, University of Rochester, Rochester, N. Y.

Refrigeration and Air Conditioning Accessories Exhibition: January 16-19, Stevens Hotel, Chicago, Ill. Manager and Committee Secretary, R. M. McClure, 111 W. Washington St., Chicago, Ill.

American Society of Heating and Ventilating Engineers: Annual meeting, January 23-26, William Penn Hotel, Pittsburgh, Pa. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

American Society of Mechanical Engineers: Spring meeting, February 23-25, New Orleans, La. Headquarters office, 29 W. 39th St., New York, N. Y.

MOISTURE BARRED

IN a Ric-wiL Underground Steam System, moisture is effectively *barred.* By the cemented Loc-liP side joint and interlocking bell end joint, and by the use of incomparable Dry-paC Waterproof Asbestos Insulation, steam efficiency is shut *in*—and water shut *out.* Deterioration is halted—Ric-wiL Conduit gives permanent protection to your lines. Don't gamble—insist on a Ric-wiL job—the conduit with a successful RECORD of nearly 30 years!

Prevent leakage and loss in your steam lines, keep them tight, dry and 90%+ efficient with a Ric-wiL Tile or Cast Iron System. Ric-wiL service is complete from design to installation and tests, and is nationwide. On any subsoil steam conveyance problem—under-supply, fuel waste, loss in transit—Ric-wiL can give you effective assistance. Write for complete catalog and test data.

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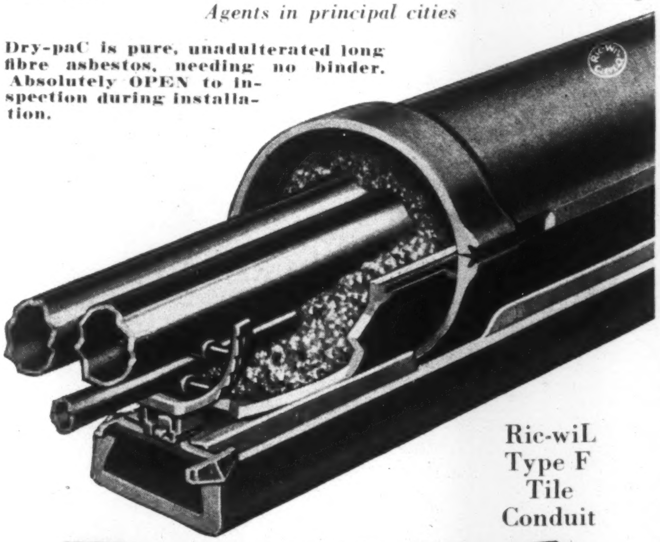
Dry-paC is pure, unadulterated long fibre asbestos, needing no binder. Absolutely OPEN to inspection during installation.



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CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

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Efficient Refrigeration and Air Conditioning at the . . .

Lowest Cost Per Year . . .

To attain this *Ideal,* any product must be

- WELL DESIGNED
- CAREFULLY MANUFACTURED
- PROPERLY APPLIED
- CORRECTLY INSTALLED
- INTELLIGENTLY OPERATED

This is *our* Ideal—*the Lowest Cost Per Year*—exemplified in every Vilter Product — every Vilter Installation. For Vilter Equipment is designed, built and installed to Performance Specifications — not to price alone!

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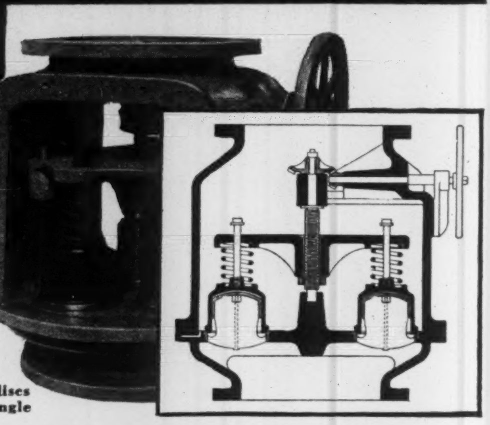
2148 S. FIRST ST. MILWAUKEE, WIS.

Superior Since 1867
VILTER
Refrigeration . . .
Air Conditioning

Cannot Stick, Jam or Freeze



MULTIPORT PRINCIPLE
A number of small discs instead of one single large disc—
INSURES CONTINUOUSLY RELIABLE OPERATION

COCHRANE MULTIPORT RELIEF VALVE

The Cochrane Multiport Valve, for the control of atmospheric relief, back pressure, flow or check valve service, uses a multiplicity of small valve discs. These fit tightly against seats, yet are released freely; no possibility of jamming or freezing—no tendency for chatter or seat-pounding.

These valves are especially valuable for steam condenser service where positive tightness under high vacuum is vital. They are giving protection in more than 12,000 plants. If *you* want absolute insurance against damages from relief valves that now stick or jam, install Cochrane Multiport Valves. Write for copy of 16-page Publication No. 2710.

Cochrane Corporation, 3131 N. 17th St., Philadelphia, Pa.

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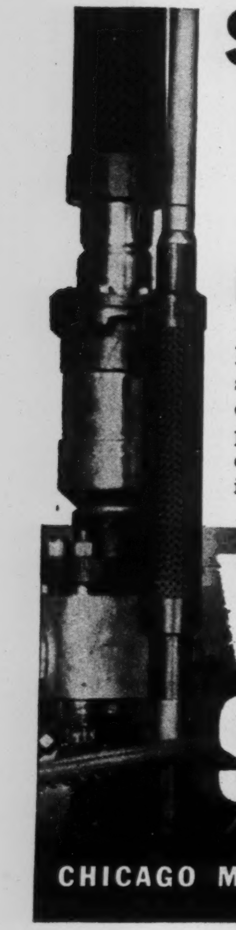
VALVES · TRAPS · SEPARATORS · SPECIALTIES

Stop VIBRATION NOISE in Compressor Lines



Rex Vibra-Sorbers absorb vibration, stop noise, insure permanently quiet operation. Sweated into the compressor lines, they act as flexible couplings for speedy, trouble-free installation. All sizes available.

VIBRA-SORBERS

Made by
CHICAGO METAL HOSE CORPORATION
Maywood, Illinois

International Acetylene Association: Annual convention, March 8-10, Rice Hotel, Houston, Texas. Headquarters office, 205 E. 42nd St., New York, N. Y.

American Society of Refrigerating Engineers: Spring meeting, May 22-23, Hotel Hershey, Hershey, Pa. Headquarters office, 37 W. 39th St., New York, N. Y.

Association of Gas Appliance and Equipment Manufacturers: Annual convention, May 24-26, Roosevelt Hotel, New York, N. Y. Headquarters office, 60 E. 42nd St., New York, N. Y.

Heating, Piping and Air Conditioning Contractors National Association: 50th annual convention, May 31-June 2, Drake Hotel, Chicago, Ill. Headquarters office, 1250 Sixth Ave., New York, N. Y.

Smoke Prevention Association: Annual convention and exhibit, June 13-16, Hotel Schroeder, Milwaukee, Wis. Headquarters office, 139 N. Clark St., Chicago, Ill.

International Acetylene Congress: 13th International Congress of Carbide, Acetylene, Oxy-Acetylene Welding and Allied Industries, June 25-July 1, Munich, Germany. International Acetylene Association, 30 E. 42nd St., New York, N. Y.

National District Heating Association: Annual convention, June 27-30, Hotel Pennsylvania, New York, N. Y. Headquarters office, 1317 Spruce St., Philadelphia, Pa.

Schools and Study Courses

University of Wisconsin Revises Correspondence Course in Heating

The University of Wisconsin home study course in heating and ventilating has been revised by the department of mechanical engineering to include the more recent advances in engineering knowledge in this field. Purpose of this course is to give an opportunity for engineers, architects, draftsmen, contractors and others to secure a better technical preparation for the work of planning, estimating, and installing heating and ventilating systems. By the home study plan this instruction can be obtained without interruption of the student's regular occupation.

The development of the unit heater, the increasing use of humidifying systems and thermostatic control, the air conditioning requirements of modern heating and ventilating systems, the closer search for heat losses at every point, and the all-around refinements of practice are examples of the present trend.

Other correspondence courses include heat, heat power engineering, steam boilers, steam engines, and refrigeration. The extension division at Madison will send catalogs and outlines of courses to those interested in further study in any of these fields.

Book Reviews

Air Conditioning

["Air Conditioning," by James A. Moyer, State Director of University Extension in Massachusetts, and Raymond U. Fittz, Assistant Professor of Mechanical Engineering, Tufts College. 2nd. ed. 1938. 455+x pp., 6 x 9 in., clothbound. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Price, $4.00.]

In this new edition of "Moyer and Fittz," the first chapter on air conditioning principles has been re-written to improve it in the light of recent practice and to simplify those parts which have been difficult for the average student and engineer to read. A new chapter giving data on sun effect, heat transmission through building materials, and methods of calculating and selecting unit air conditioners has been added and several of the

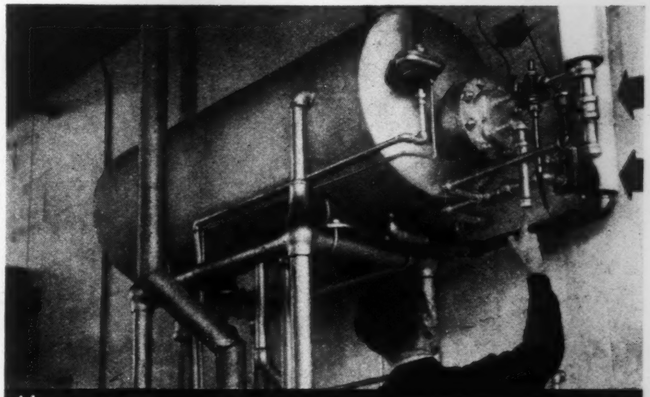
NO MAINTENANCE TROUBLES WITH *this* UNIT HEATER

MODEL NO. 20
GRID UNIT

Its heating sections (shown here with casing removed) are cast aluminum alloy, cast in one piece and bonded to high-test nickel alloy iron steam chamber. In it no two dissimilar metals are in contact with each other and steam or hot water to produce electrolytic action. Grid Unit Heaters never fall apart from corrosion. Their maintenance cost is practically nothing—some in use as many as 9 heating seasons without expense.

THE UNIT HEATER & COOLER CO., Wausau, Wisconsin
Offices in all principal cities

GRID UNIT HEATER



"WE BUY STEAM

—That's why we standardize on Sarco for the control of our hot water temperatures."

Sarco Temperature Regulators pay for themselves quickly by preventing wasteful over-heating, by protecting the quality of heat processed goods—by saving steam, labor and overhead.

The illustration above shows a Sarco Temperature Regulator, a Sarco Float Trap and a Sarco Thermostatic Drip Trap on Water Heater.

Get the full story by writing for Catalog No. 52, or this new data book.

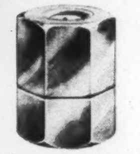
STEAM HOOK-UPS
52

SARCO THERMOSTATIC, FLOAT AND BUCKET TRAPS, REGULATORS AND HEATING SPECIALTIES

SARCO COMPANY, INC., 183 MADISON AVENUE, NEW YORK, N.Y.
SARCO CANADA, LTD., FEDERAL BLDG., TORONTO, ONTARIO

A *Better Spray* NOZZLE *for Water Cooling*

Many Special Types for Special Purposes Including


Air Humidifying

Ice Melting

Air Washing and Brine Spraying

This MARLEY Non-Clog Nozzle Saves Industry Many Thousands of Dollars Each Year!

Because it operates efficiently at low pressures it saves on pumping cost.

Because it has no internal parts to clog or wear it saves on cleaning, repair and replacement cost.

Because of its finer, more uniform spray it is the most effective water cooling nozzle ever devised, saving on the number required to handle any given heat load.

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For the **PARTICULAR MOTOR APPLICATION** *You Need*

HOLTZER-CABOT *Custom Built* MOTORS

~ *Write and Let Us Help You* ~

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ELECTRIC COMPANY
BOSTON ~ ~ ~ ~ ~ MASS.
CHICAGO · NEW YORK · PHILADELPHIA ·

A HELPFUL HINT ABOUT

TAKING INVENTORY

Go over your steam boiler equipment carefully! You may list it as an asset but, unless it's fully automatic and in first class condition, it really rates as Business Liability No. 1.

NOW IS THE TIME TO REPLACE
OBSOLETE STEAM BOILERS!

You'll find the savings pay for a good gas-fired KANE Boiler. **Savings in *time*: the KANE is operated automatically, requires practically no manual attention; and savings in *actual cash*: the KANE burns fuel only in proportion to the steam required, isn't wasteful.**

Details? They're all yours if you write us on your letterhead. We'll send you complete construction data, certified performance reports—*and there is no obligation.*

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UNIT HEATERS
ALL PRESSURES
DURABLE QUIET

KRAMER TRENTON AUTO RADIATOR WORKS
TRENTON, N. J.

illustrative designs given in the first edition have been re-calculated. The chapter on automatic control apparatus has also been revised.

There are 18 chapters, on air conditioning principles, ventilation requirements, air filtration, cooling methods, refrigeration, refrigerants, refrigerating equipment, temperature and humidity control equipment, design of temperature and humidity control systems, fans and auxiliary equipment, heat transfer and unit coolers, office buildings, theaters, restaurants, food factories and textile mills, railroad passenger cars, air conditioning for residences and residence heating with refrigeration equipment. An appendix gives 58 problems and includes several pages of tables.

Many sources have been drawn on in the preparation of this book, including the A. S. H. V. E. *Guide*, H. P. & A. C., the *General Electric Review*, *Electric Journal*, and several textbooks.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 126. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 2998. AIR CONDITIONING: Frick Co., Waynesboro, Pa. 6 p. issue of "The Frick System" (Vol. 10, No. 4) describing various installations in New England where this manufacturer's equipment is used for air conditioning.

No. 2999. BACTERIA CONTROL: Oakite Products, Inc., 22 Thames St., New York, N. Y. 16 p. booklet on bacteria control in air conditioning telling how bacterial growths can be controlled in systems where the air is washed by a recirculating water supply and discussing protection of equipment against corrosion, and prevention of slime and algae growths and water scale formation.

No. 3000. CONDENSATION METERS: American District Steam Co., North Tonawanda, N. Y. 12 p. bulletin (35-80A) on metering steam accurately in the form of condensate, illustrating and describing "Adsco" rotary condensation meter and giving installation diagrams and photographs.

No. 3001. CONDENSATION PUMPS: Sterling Engineering Co., 3738 N. Holton St., Milwaukee, Wis. 8 p. bulletin (384) on condensation pump units (pumping unit mounted on the side of the receiver) having capacities of 5000 sq ft.

No. 3002. ELECTRICAL APPARATUS: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 8 p. bulletin on how to select electrical apparatus for air conditioning and refrigeration equipment, with information on compressors, fans, pumps, circuit protection, and giving a table summarizing motor types for these applications, manual and magnetic control, and circuit protection for each.

No. 3003. EVAPORATIVE CONDENSERS: York Ice Machinery Corp., Roosevelt Ave., York, Pa. Specification and dimension sheet (38393) on the "Economizer" self-contained, forced draft, cooling tower and refrigerant condenser for small air conditioning and refrigeration installations.

No. 3004. FITTINGS: Stanley G. Flagg & Co., Inc., 1421 Chestnut St., Philadelphia, Pa. 182 p. catalog (60) of malleable iron, cast iron, and red brass fittings, giving list prices and with a comprehensive cross-index.

No. 3005. HEATING COILS: Bush Mfg. Co., 100 Wellington St., Hartford, Conn. 12 p. catalog of booster unit section heating coils, with information on how to select the proper unit, dimensions and physical data, rating tables, rating charts, and installation instructions.

No. 3006. HEATING PUMPS: C. A. Dunham Co., 450 E. Ohio St., Chicago, Ill. 32 p. bulletin (602) on heating pumps and accessories, describing four pump types to meet all heating conditions, telling the "inside story" of the vacuum pump,

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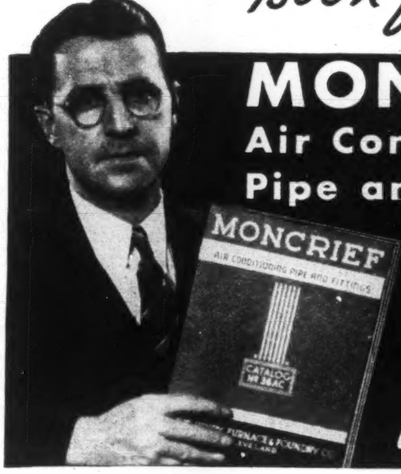

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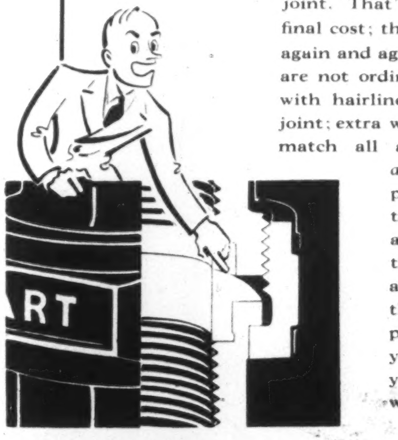

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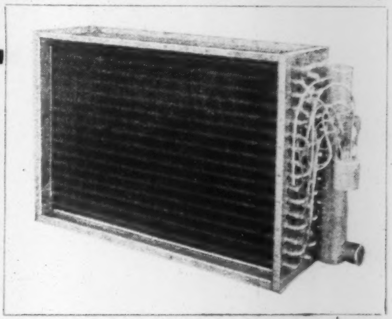

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with cross-sections showing operation and describing basis of capacity ratings, and discussing in detail construction features. A section is included on control, and information is given on capacities, dimensions, installation details, operation, and specifications.

No. 3007. HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT: Melchior, Armstrong, Dessau Co., 300 Fourth Ave., New York, N. Y. 138 p. catalog (138) with dealer price list, including an alphabetical index of products and firms with the pages on which the products are cataloged. Also, a similar 158 p. catalog with price list on electric refrigeration supplies.

No. 3008. HEAT TRANSFER EQUIPMENT: Davis Engineering Corp., 1064 E. Grand St., Elizabeth, N. J. 24 p. condensed catalog (600) on "Paracoil" heat transfer equipment, including "Chillblast" air conditioners, coolers and dehumidifiers; proof box air conditioners; chocolate cooling and packing tables; fuel oil heaters; heat exchangers; instantaneous heaters; storage water heating elements; waste heat boilers; condensate coolers; and other equipment.

No. 3009. INSULATING AND CUSHIONING MATERIALS: American Hair & Felt Co., 1820 Merchandise Mart, Chicago, Ill. 28 p. catalog (38) showing the manufacturer's entire line of "Ozite" hair felt products for thermal insulation, sound absorption and general cushioning. The various materials are described and illustrated and specifications are given.

No. 3010. INSULATION: Pacific Lumber Co., 102 Bush St., San Francisco, Cal. 16 p. booklet on "Palco Wool" insulation, discussing the advantages of building insulation in summer and winter, how this product meets the requirements, and giving comparison charts and information on installation. Also a 16 p. cold storage manual describing insulation in the cold storage field, giving recommended thicknesses, information on how to figure over-all heat loss, and showing numerous construction details.

No. 3011. MONEL: International Nickel Co., Inc., 67 Wall St., New York, N. Y. 16 p. bulletin of technical information (T-9) on engineering properties of "K" Monel, with data on composition, physical constants, properties, working instructions, heat treatment, corrosion resistance, mill products and applications.

No. 3012. PACKINGS: Alexander Brothers, 406 N. Third St., Philadelphia, Pa. 32 p. booklet on leather packings for industrial purposes, with illustrations and installation views of the various types, standard price lists, and useful practical data.

No. 3013. PIPE REPAIR CLAMPS AND SADDLES: M. B. Skinner Co., South Bend, Ind. 32 p. catalog (38A) on repair clamps and saddles for steel and cast iron pipe for making permanent repairs in steel, hot water, cold water, gas, oil, ammonia, or brine lines. The various types of clamps are illustrated and described and tables of the cost of leaks of various sizes in air, steam, water and oil piping are featured.

No. 3014. PLANING MILL EXHAUSTERS: B. F. Sturtevant Co., Damon St., Hyde Park, Boston, Mass. 12 p. catalog (430) on planing mill exhausters for collecting and conveying shavings, sawdust, chips, dust from emery and buffing wheels, and other materials which can be conveyed on a current of air.

No. 3015. PNEUMATIC COLLECTING AND CONVEYING: B. F. Sturtevant Co., Damon St., Hyde Park, Boston, Mass. 64 p. catalog (291-1) on pneumatic collecting and conveying systems divided into two parts, the first on description of apparatus, and the second on data covering design, application of collecting systems, and how to lay out such systems. The booklet includes a wealth of engineering data and many pertinent tables and drawings.

No. 3016. PROCESS CONTROL: Bristol Co., Platts Bridge, Waterbury, Conn. Folder describing system of coordinated process control, illustrating a number of installations.

No. 3017. RECORDERS: C. J. Tagliabue Mfg. Co., 540 Park Ave., Brooklyn, N. Y. 12 p. bulletin (1178) on "Tag"

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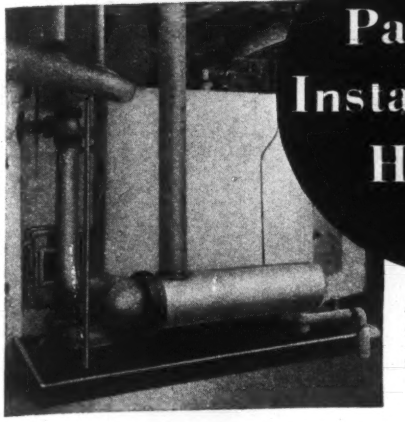

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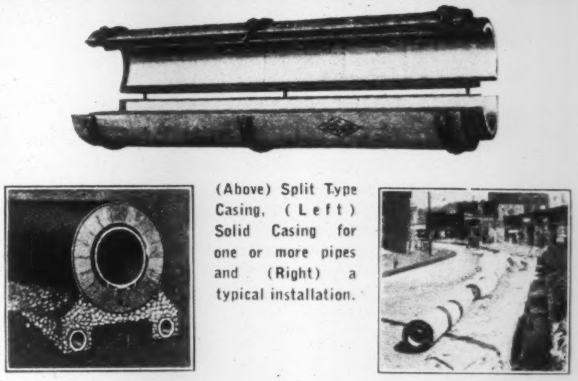

(Above) Split Type Casing, (Left) Solid Casing for one or more pipes and (Right) a typical installation.

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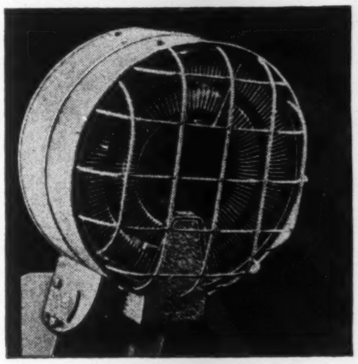

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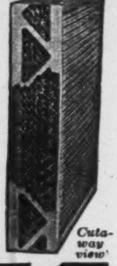

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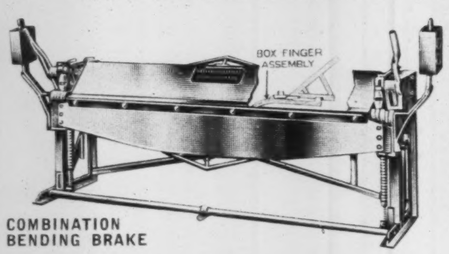

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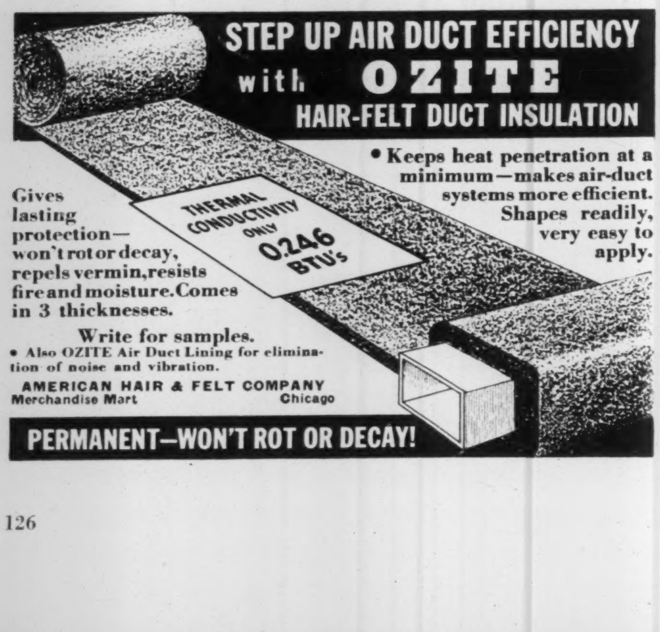

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indicating, recording and controlling instruments for temperature and pressure, announcing a new line of 9 in. chart recorders and recorder-controllers with $3\frac{5}{16}$ in. pen travel.

No. 3018. SHEAVES: Allis-Chalmers Mfg. Co., Milwaukee, Wis. Leaflet (2333) on 2-3-4 adjustable single groove combination sheaves giving sectional views and showing how the outer sheave plate can be reversed for greater speed range without removing the sheave from its shaft.

No. 3019. STOKERS: Detroit Stoker Co., General Motors Bldg., Detroit, Mich. 16 p. catalog on multiple retort stokers. Features include fuel feed adjustment for each retort, control of fuel distribution, zoned air to all sections of fuel bed, moving extension grates with a slicing action, inclined fuel bed with complete underfeed action, and easy adjustments of coal feed and distribution. Various parts of the stoker are illustrated in detail and drawings showing applications to various types of boilers are presented.

No. 3020. TUBE WASHERS: Worthington Pump & Machinery Corp., Harrison, N. J. 4 p. bulletin (W-200-B4) on hydraulic tube washers for surface condensers, describing and illustrating the equipment.

No. 3021. UNIT HEATERS: Airtherm Mfg. Co., 1474 S. Vandeventer Ave., St. Louis, Mo. 8 p. bulletin describing the "Directherm" direct fired unit heater for gas, oil and coal (stokers or hand firing). A general description, specifications, and other information are included.

No. 3022. UNIT HEATERS: Trane Co., La Crosse, Wis. 20 p. bulletin (S327) on unit heaters of various types, discussing the advantages of unit heating, illustrating and describing various installations, and giving detailed data on the manufacture of various types and their advantages.

No. 3023. VALVES: Edward Valve & Mfg. Co., Inc., 1200 W. 145th St., East Chicago, Ind. 8 p. booklet containing reprints of advertisements to valve users, discussing methods used in the manufacturer's laboratories for research and production testing of valve materials.

No. 3024. WELDING PROCEDURES: Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio. 36 p. bulletin (401-A) on arc welding electrodes and accessories with procedure for the welding of various metals, giving complete procedures for the following: flat, vertical or overhead welding of mild steel; single or multiple pass welding and for poor fit-up in mild steel; flat welding of fillet welds in mild steel; flat welding of deep groove joints in mild steel; flat welding of deep groove joints in high tensile steels; general welding of high tensile steels; welding of light gage steel, 18-8 and 25-12 stainless steels, 4-6 chrome steels, high manganese steel, cast iron, aluminum, bronze, brass and copper; for surfacing to produce moderate shock and abrasion resisting welds; rolling or sliding abrasion resisting welds; and for making tool steel cutting edges on ordinary steel and rebuilding worn tools and dies.

DEC 6

Heating • Piping and Air Conditioning

n • Installation
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NDUSTRY AND
E BUILDINGS

CEMBER, 1938

ontents—Page 31
8 Index—Page 119

—Journal [illegible]
Society of Heating
tilating Engineers

Dr. Charles Flint and Nurse Geneva Broene are interested in one of the panels which absorb radiated bodily heat in an operating room at Blodgett Memorial Hospital. The installation is described briefly on p. 762.

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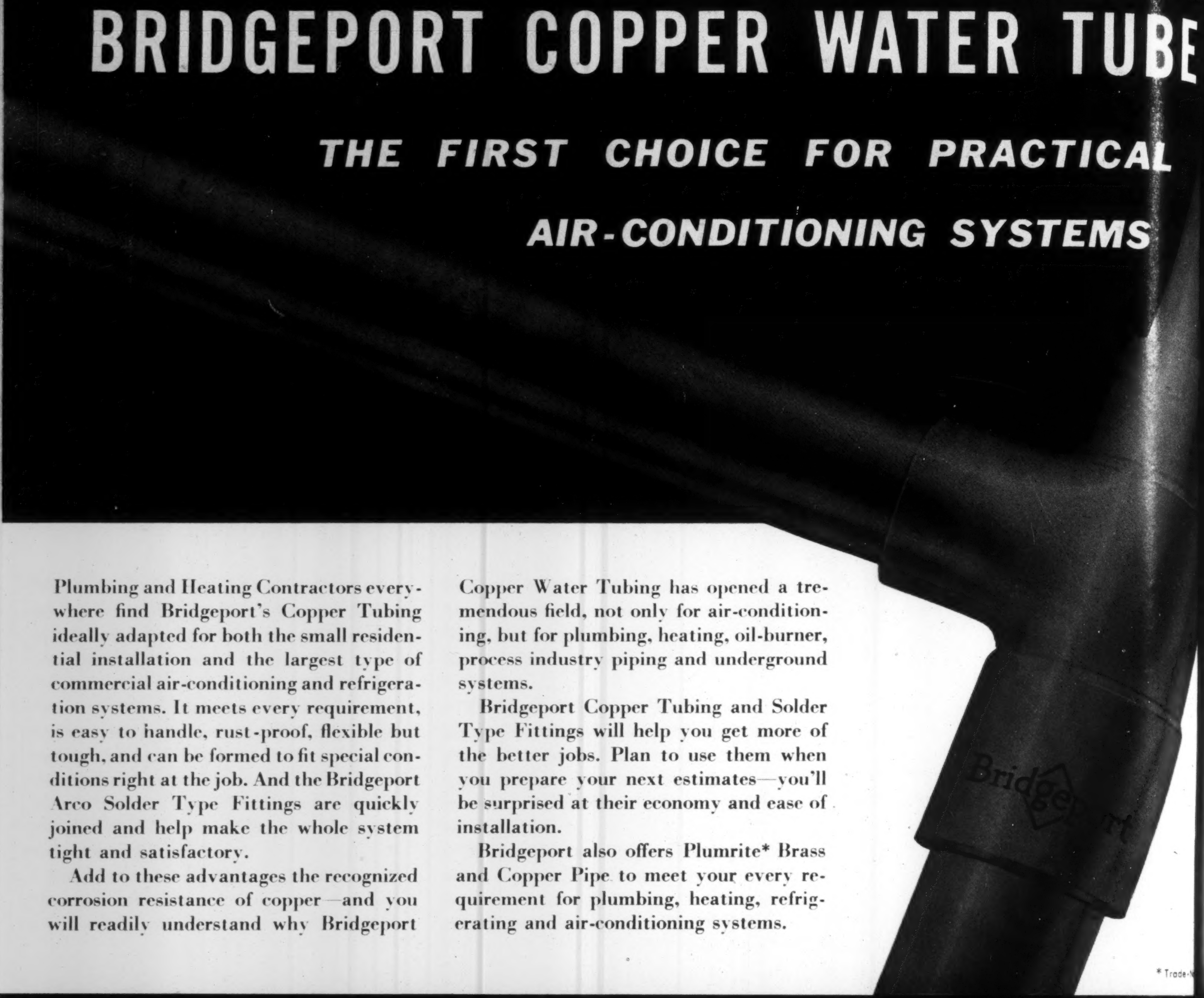

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Add to these advantages the recognized corrosion resistance of copper—and you will readily understand why Bridgeport Copper Water Tubing has opened a tremendous field, not only for air-conditioning, but for plumbing, heating, oil-burner, process industry piping and underground systems.

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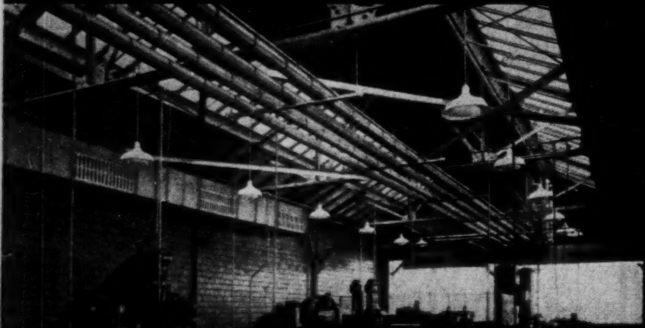

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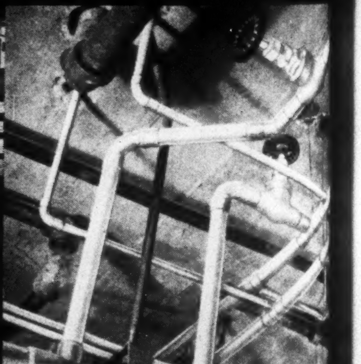

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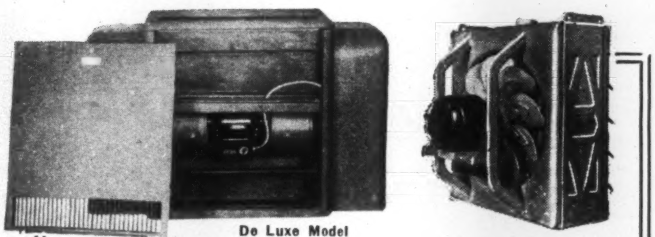

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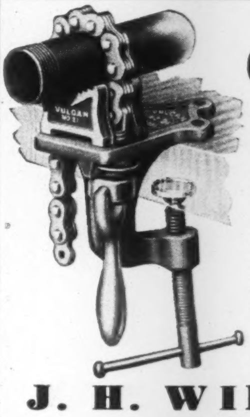

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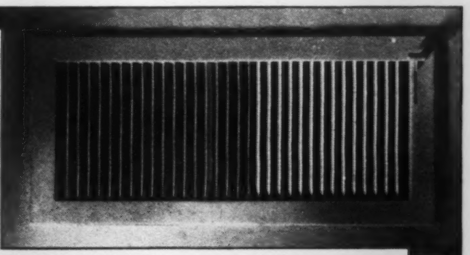

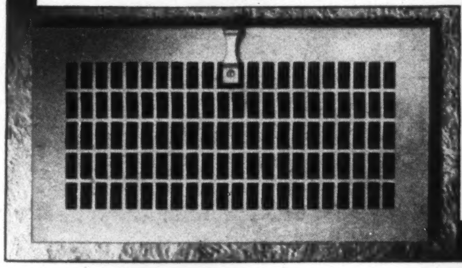

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SALESMEN WANTED—One of the largest and oldest manufacturers in the heating and air conditioning industry has openings for experienced, aggressive salesmen in the following territories: 1. Southwestern States; 2. Midwestern States; 3. Atlantic Seaboard. Complete line of nationally advertised coal, oil and gas-fired equipment, also registers, grilles, prefabricated and gravity furnace pipe and fittings. Warehouse stocks adjacent to Midwestern and Atlantic Seaboard territories. Give complete information in first letter, including previous experience, sales record, references and acquaintance with heating trade. Include recent snap-shot photo, if available. Address Key No. 303-A, Heating, Piping and Air Conditioning, 6 No. Michigan Ave., Chicago, Illinois.

8 cents for each word including heading and address. Count nine words for keyed address. Minimum $2.00 for each insertion. One inch $4.00. Cash must accompany order. Copy must be in our hands by the twenty-fifth of the month previous to issue.

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The owners of a modern metal and woodworking plant in eastern Pennsylvania are interested in additional lines, and invite inquiries for the manufacture and assembly of equipment or parts for air conditioning. This plant consists of fifty acres, and has several buildings, one of 200,000 sq. ft. and one of 40,000 sq. ft.; also machine shop, foundry and forge shops. Located on a main line railroad, and in a desirable skilled labor market. Capital is available for additional equipment. Address inquiries to G. M. Basford Co., 60 East 42nd St., New York City.

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Quiet

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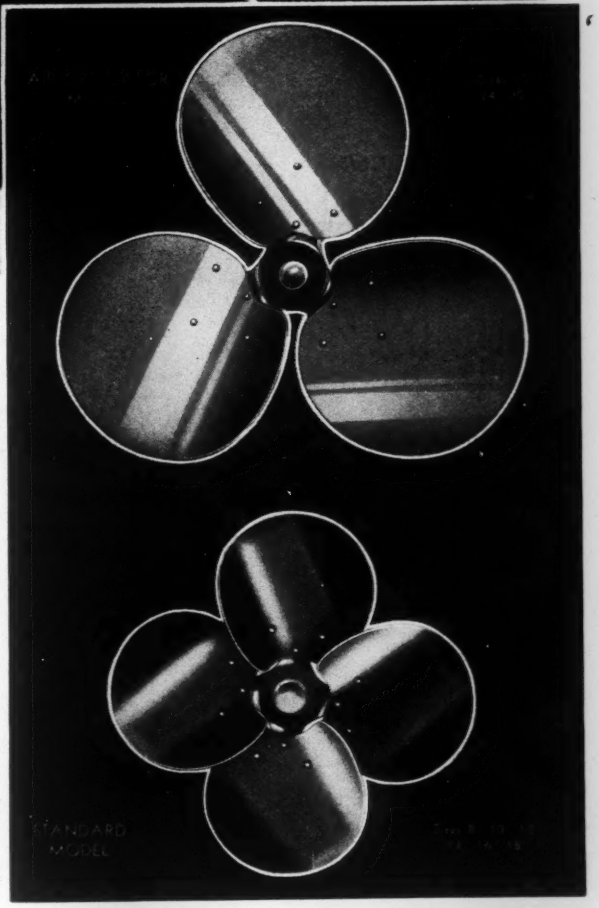

AIRISTOCRAT
TRADE MARK REGISTERED

Quiet Propeller Fan Blades operate smoothly, quietly — as nearly noiseless as modern science can make them. Developed through exhaustive research by thoroughly experienced engineers, these are the quietest fans ever manufactured by TORRINGTON. Their unique, patented construction, combining ruggedness and beauty with quiet performance, makes the AIRISTOCRAT outstanding . . . .

Patent Nos. 2,021,707 and 2,072,322

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The Torrington Mfg. Co.
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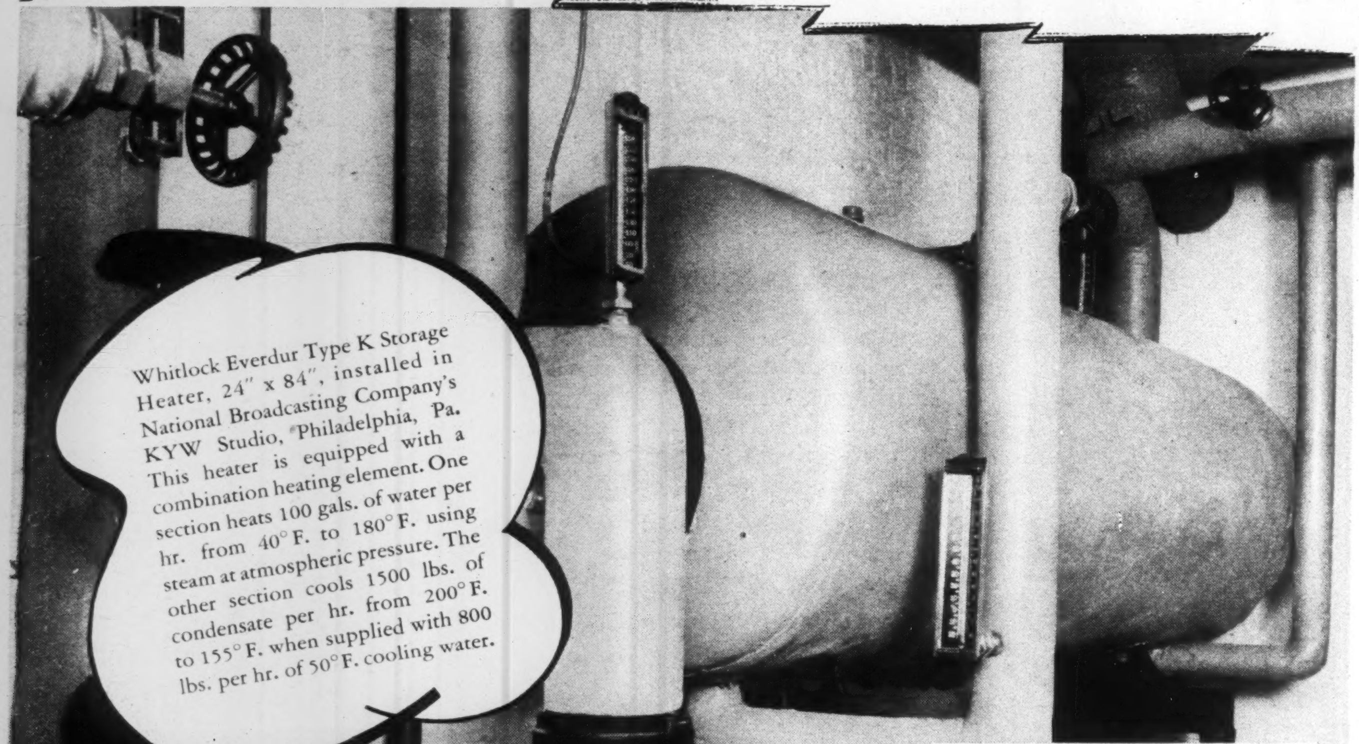
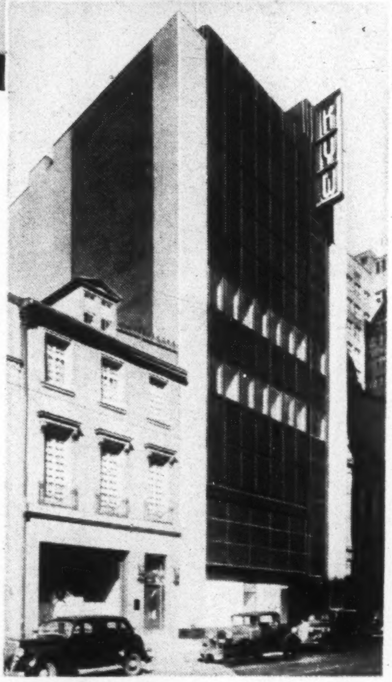


Whitlock Everdur Type K Storage Heater, 24" x 84", installed in National Broadcasting Company's KYW Studio, Philadelphia, Pa. This heater is equipped with a combination heating element. One section heats 100 gals. of water per hr. from 40° F. to 180° F. using steam at atmospheric pressure. The other section cools 1500 lbs. of condensate per hr. from 200° F. to 155° F. when supplied with 800 lbs. per hr. of 50° F. cooling water.



THE TREND toward modern, more efficient water heating practice is increasing rapidly. This is one reason why heater shells of non-rust Everdur are in such great demand by building and plant owners throughout the country. They have realized that, with Everdur, they get long term economy. Everdur heater shells will be giving excellent service long after those made of rustable metals have been discarded.

RUSTLESS AND STRONG

Everdur —The American Brass Company's copper-silicon-alloy —is rustless as copper, yet exceptionally strong. It is easily welded and reasonable in price. This rare combination of qualities means rust-free hot water indefinitely, and reduced expense for upkeep. Everdur tanks and heaters are available for every purpose from leading equipment manufacturers.

8899

Everdur TANK METAL

ANACONDA
from mine to consumer

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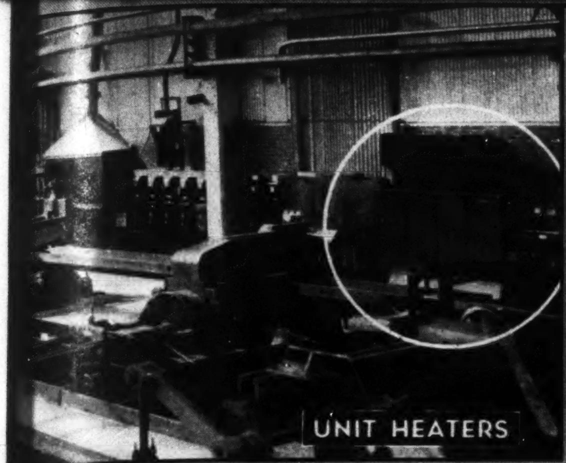
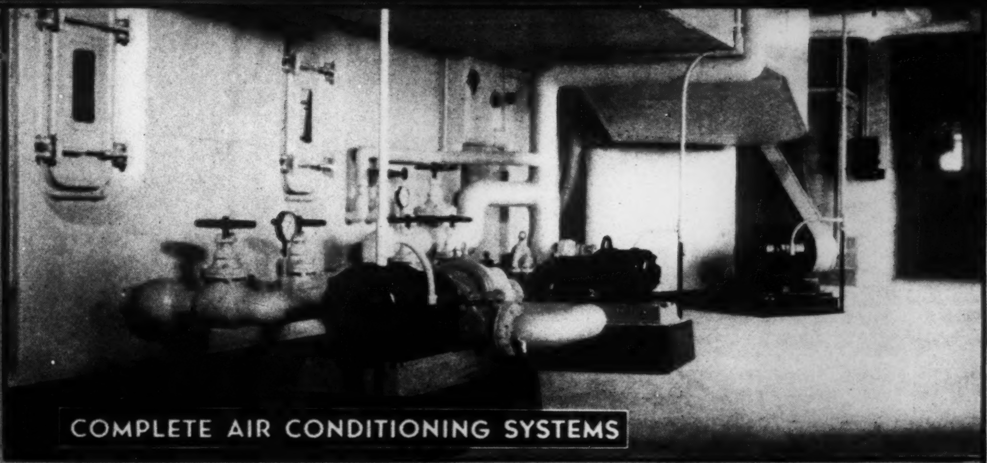
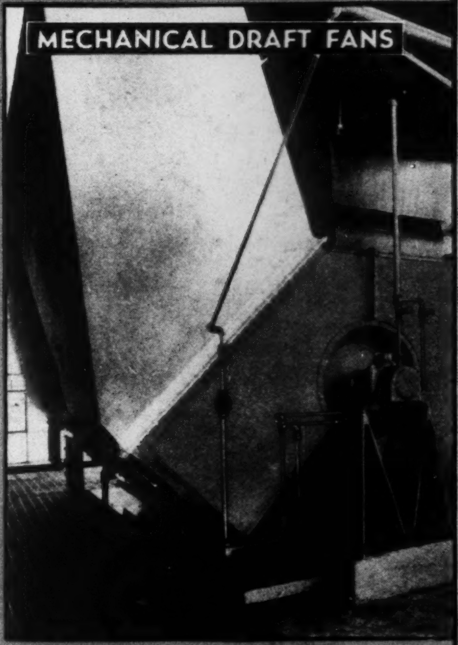
In Canada: Anaconda American Brass Ltd., New Toronto, Ont. • Subsidiary of Anaconda Copper Mining Co.

EVERDUR is a trade-mark of The American Brass Company, registered in the United States Patent Office.







WHICH TYPE? WHAT SIZE?

in Every Case We Can Furnish a Satisfactory, Economical Answer

In this broad line of time-tested Clarage equipment you will find the solution to any air handling or conditioning problem. And from our wealth of experience—dating back more than a quarter-century—will come invaluable suggestions for meeting your requirements at lowest possible cost consistent with unquestionable quality.

FANS AND BLOWERS:—High speed and low speed designs for all types of ventilating and exhaust services. Operating costs invariably below expectations.

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UNIT HEATERS:—Centrifugal fan units for large space factory heating with Syncrotherm Temperature Control patented feature; floor mounted or suspended. Propeller fan units, suspended type, for small area heating.

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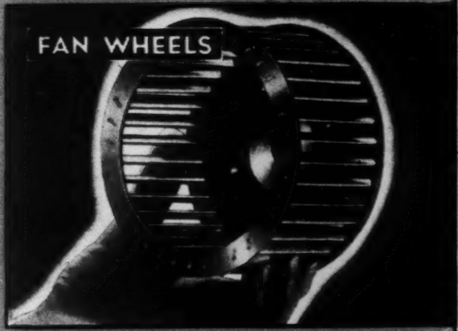
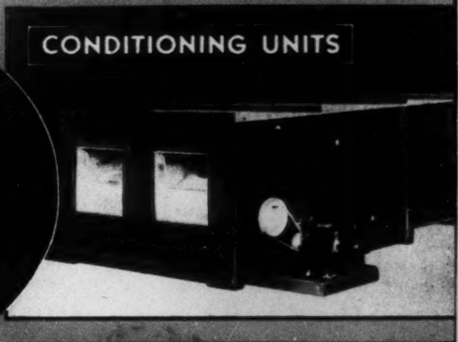
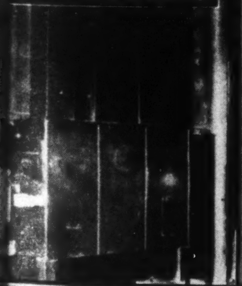
VORTEX CONTROL:—Patented feature adaptable to any Clarage fan. Regulates fan capacity at constant speed operation. Eliminates need for expensive variable speed motor and elaborate control equipment.

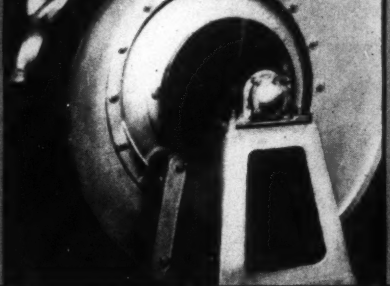
How can we help you—by sending descriptive literature—or by having our nearest Clarage sales-engineer call?

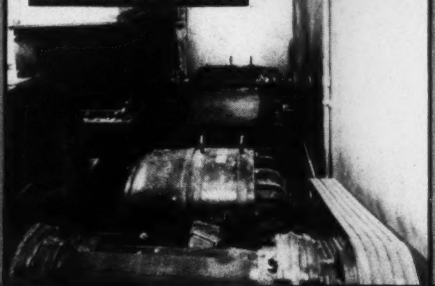
CLARAGE FAN COMPANY
KALAMAZOO, MICHIGAN
Sales Engineering Offices In All Principal Cities

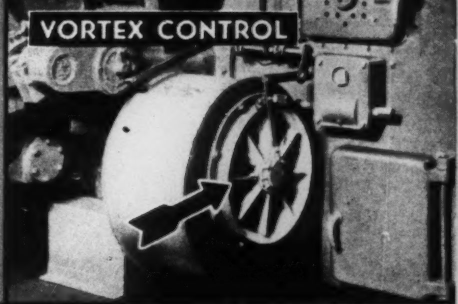












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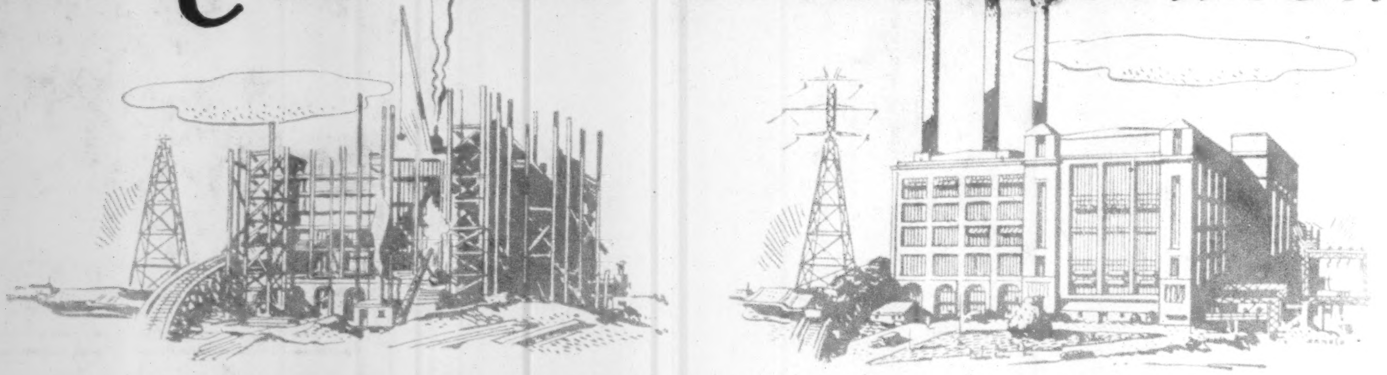

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